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WHEAT PRODUCTION *and* MARKETING

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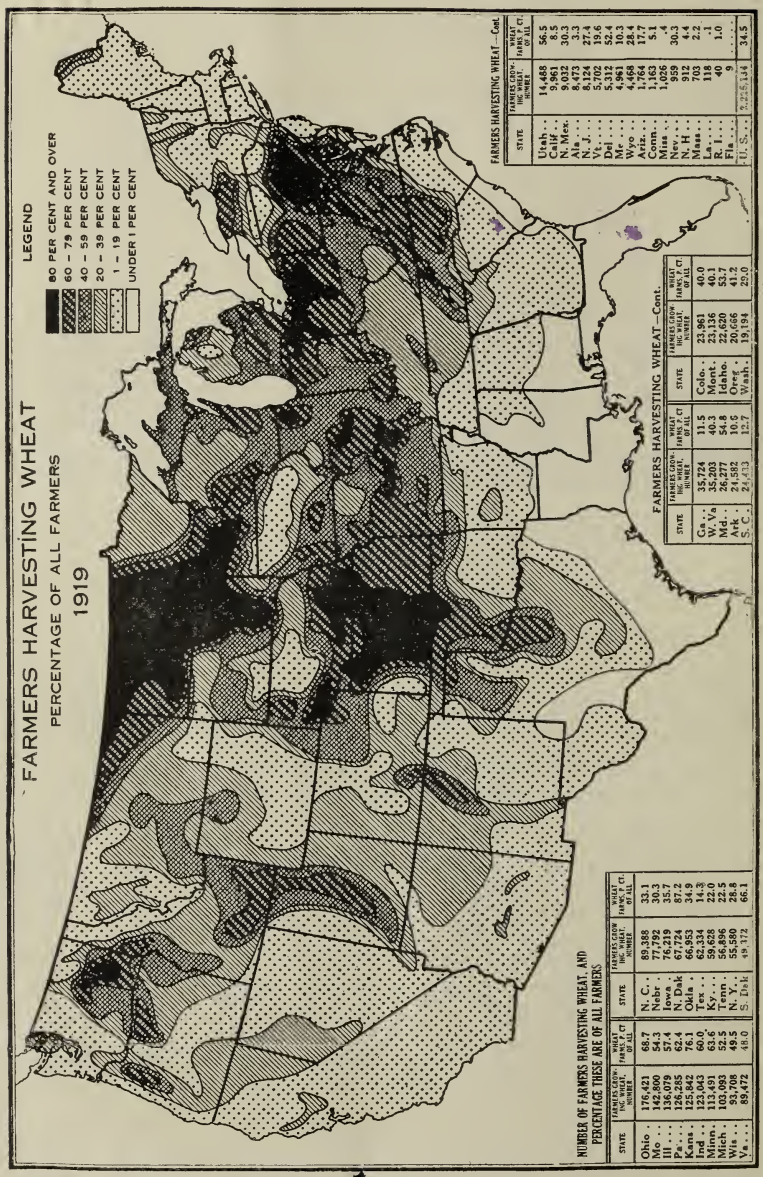
Importance of the Wheat Crop.

WHEAT is one of the most important crops of the United States. It is important because (*a*) many farmers grow it, (*b*) a large acreage of land is annually devoted to it, (*c*) it constitutes an important part of our domestic commerce, (*d*) it contributes a large part of the value of the exports of the nation, and, most important of all, (*e*) it is the national bread crop.

In some areas in the United States wheat is almost the only source of income. About one-third, or approximately 2 millions, of the farmers of the United States grow wheat. In many of the northern States more than one-half, and in large areas over 80 per cent, of the farmers are engaged in wheat growing (Fig. 1). In 1921 over 62 millions of acres were harvested. Only corn and hay exceed wheat in the acreage occupied. In the great wheat-growing States there are areas in which more than 50 per cent of the total cultivated land is given over to wheat. In these areas, where there is such specialization in wheat growing, whatever



STATE	FARMERS GROW ING WHEAT. NUMBER	WHEAT FARMS, P. CT. OF ALL	STATE	FARMERS GROW ING WHEAT. NUMBER	WHEAT FARMS, P. CT. OF ALL
Ohio	176,421	68.7	N. C.	89,388	33.1
Mo	142,800	54.3	Nebr	77,792	30.3
Ill	136,079	57.4	Iowa	76,219	35.7
Pa	126,285	62.4	N. Dak	67,724	57.2
Kans	125,842	76.1	Okla	66,953	34.9
Ind	123,164	60.0	Tex	64,461	14.8
Minn	113,491	63.6	Ky.	59,628	22.0
Mich	103,093	52.5	Tenn	56,896	22.5
Wis	93,708	49.5	N. Y.	55,580	28.8
Va	89,472	48.0	S. Dak	49,372	66.1

STATE	FARMERS GROW ING WHEAT. NUMBER	WHEAT FARMS, P. CT. OF ALL	STATE	FARMERS GROW ING WHEAT. NUMBER	WHEAT FARMS, P. CT. OF ALL
Ca.	35,724	11.5	Colo.	23,961	40.0
W. Va	35,203	40.3	Mont.	23,136	40.1
Md.	26,277	54.8	Idaho.	22,620	53.7
Ark	24,582	10.6	Oreg	20,666	41.2
S. C.	24,433	12.7	Wash.	19,194	22.0

STATE	FARMERS GROW ING WHEAT. NUMBER	WHEAT FARMS, P. CT. OF ALL	STATE	FARMERS GROW ING WHEAT. NUMBER	WHEAT FARMS, P. CT. OF ALL
Utah	14,488	56.5	Wyo.	4,464	28.4
Calif	9,961	8.5	Ariz.	1,764	17.7
N. Mex.	9,032	30.3	Conn.	1,163	5.1
Alabama	8,473	3.1	Miss	1,026	.4
N. J.	8,124	27.3	Nev.	929	30.3
Vt.	5,702	19.6	N. H.	912	2.7
Del	5,312	52.4	Mass.	703	2.2
Mr	4,961	10.3	La.	118	.1
Wash.	4,464	22.0	R. I.	40	1.0
Ariz.	1,764	17.7	Fla.	9	
Conn.	1,163	5.1	U. S.	2,215,144	34.5
Miss	1,026	.4			
Nev.	929	30.3			
N. H.	912	2.7			
Mass.	703	2.2			
La.	118	.1			
R. I.	40	1.0			
Fla.	9				
U. S.	2,215,144	34.5			

FIG. 1.—Map showing the percentage of all farmers harvesting wheat in 1919. The black areas show where 80 per cent or more of the farmers grow wheat. In New England, the South, and the Southwest comparatively few farmers grow it.

affects yields, cost of production, or the price of wheat not only directly affects the welfare of all the farmers who are dependent upon the crop for a part or all of their income, but also vitally affects the whole community.

Wheat plays an important part in the commercial life of the nation. Normally it is fourth in value among all our crops, being outranked only by corn, hay, and cotton. It enters into the trade to a far greater extent than any other of these crops except cotton. The South, which produces cotton, is dependent upon the North for its wheat and flour. The manufacturing cities of the East depend upon the Midwest for most of their bread supplies.

Wheat and flour made from wheat constitute a very important part of our international trade (Fig. 2). In value of crops exported it stands second only to cotton. Both corn and hay have a total-product value greater than that of wheat, but are exported principally through meat products. Of these products only pork exceeds wheat in value.

Wheat is our great bread crop. The farmers of the United States regularly produce enough wheat not only to supply our own needs for bread but also to export a large quantity to other countries. Our population is increasing, and as consumers we are interested in the trend of wheat production. We want plenty of bread and we want it cheap.

In time of war the supply of wheat is a matter of great concern to the nations involved in the struggle. From the beginning of the World War it was recognized that wheat was as essential to winning the war as were munitions for the Army. The Allies, not having within their own borders a sufficient supply of wheat, made extraordinary efforts to keep open the international trade routes to the countries producing a surplus of wheat.

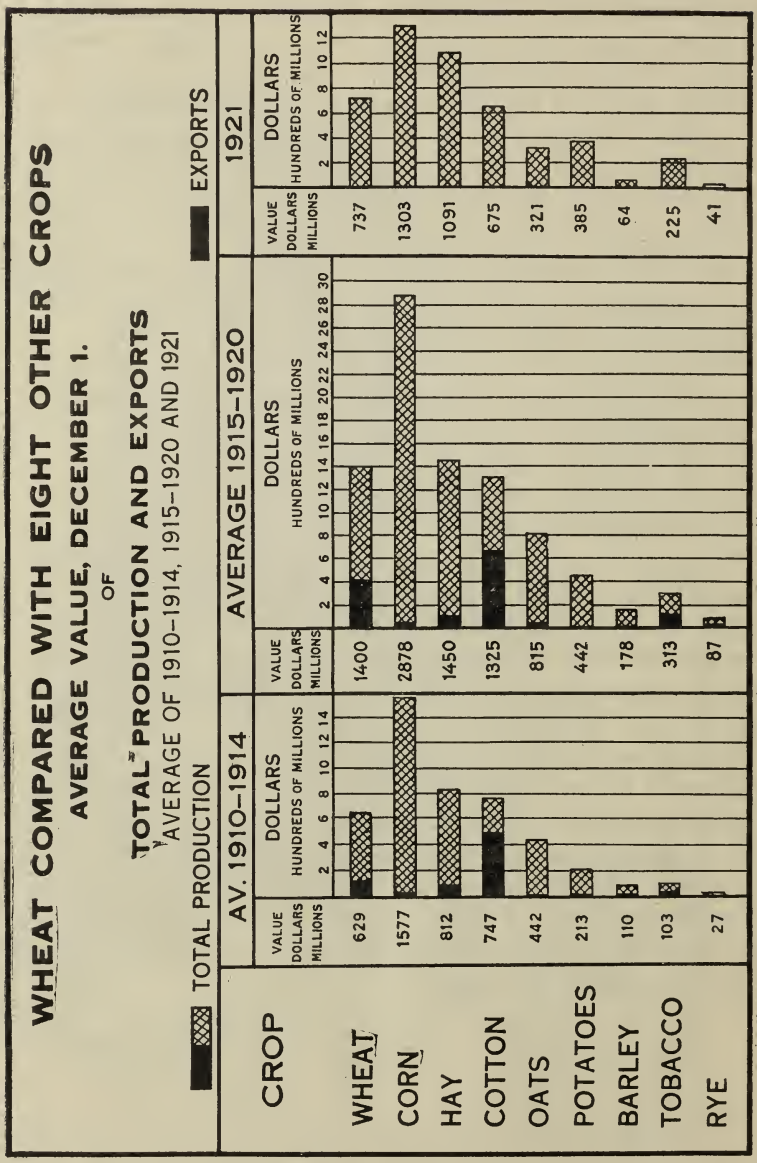


FIG. 2.—Comparative average value of wheat and 8 other crops. Wheat ranked fourth in value in the 11 years 1910 to 1920 and third in 1921, when the value of all crops had shrunken greatly. Wheat ranked second in value of crop exported.

World Production of Wheat.

The wheat growers of the United States have a vital interest in the wheat production of other countries, because the price of wheat on the farms in the United States is determined, in large measure, by the prices paid in the world markets. The distribution of wheat production in the world is shown graphically by the map in Figure 3 and total production in Figure 4. Certain countries stand out on the map as large producers of wheat. European countries produce large quantities of wheat, but most of them consume large quantities also. The important surplus producing countries which compete with the United States in the world markets are Russia, India, Canada, Argentina, and Australia (Figs. 5 and 6).

Wheat is not grown to any extent in the warm, humid parts of the world. It is confined almost entirely to regions with temperate climates. Where the moisture is not excessive, it may be grown in relatively warm climates, as in northern Africa, India, and Mexico. To the north, in Canada and Russia, production is limited by too short growing seasons. In Australia and Argentina, as well as in some parts of North America and Asia, expansion of area is limited by lack of precipitation. There are no available statistics of wheat production in China. Some wheat is grown in China, but the great food crops of the people in that part of the world are rice and various millets. Within the area suitable for growing wheat it must compete with other grain crops such as oats, corn, barley, and rye.

The large number of producers tends to stabilize the markets and, under normal conditions, to insure the world's bread supply. The crops of Russia and the United States (Figs. 5 and 6) constitute a large part of the world crop, but frequently when the crops of the United States are good the Russian crop is short. In 1911 the crops of both of these great producers were short, but the crops of other countries were good and partly offset the shortage. Thus the several countries supplement each other in producing wheat for the world markets. In years in which crops are short in one or

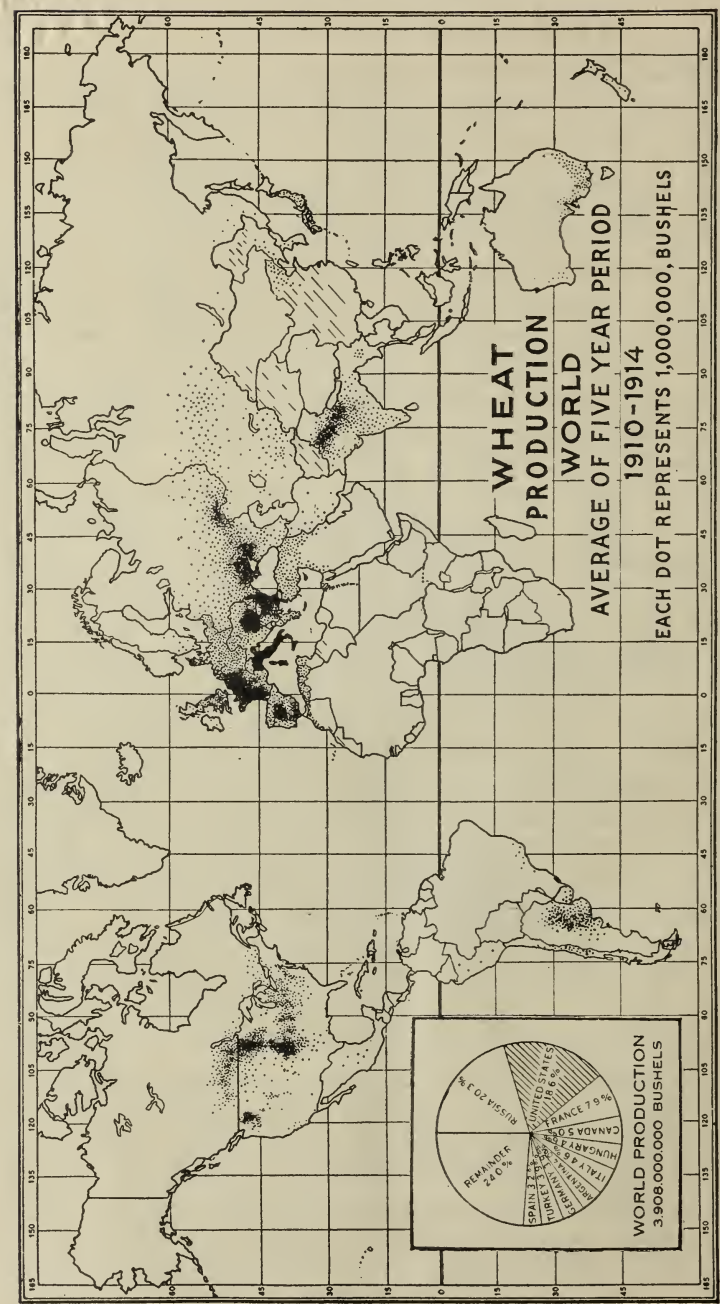


FIG. 3.—World wheat production before the war. Russia was then the greatest producer in the world and the United States was second. No satisfactory statistics of production since the war are available from some important producing countries. The North Temperate Zone produces most of the world wheat.

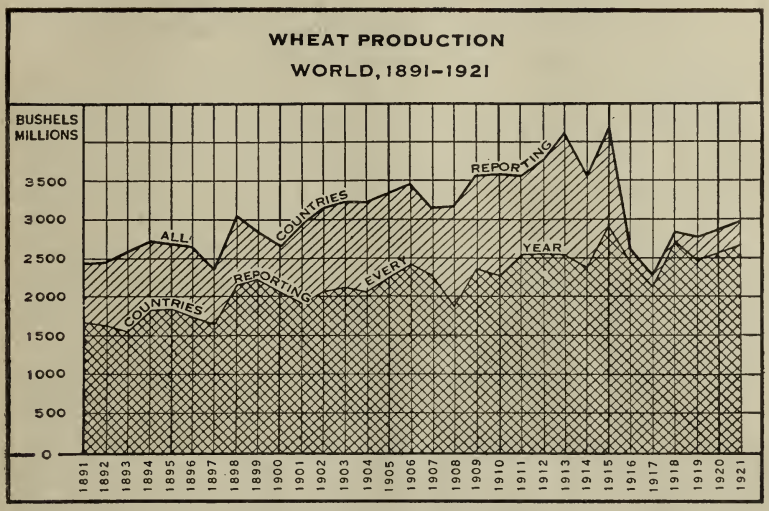


FIG. 4.—World wheat production in the 31 years 1891 to 1921 in all countries reporting. Since the beginning of the World War satisfactory statistics have not been available every year from Russia, Roumania, Bulgaria, Hungary, Austria, and Mexico. Note the steadily increasing production before the war.

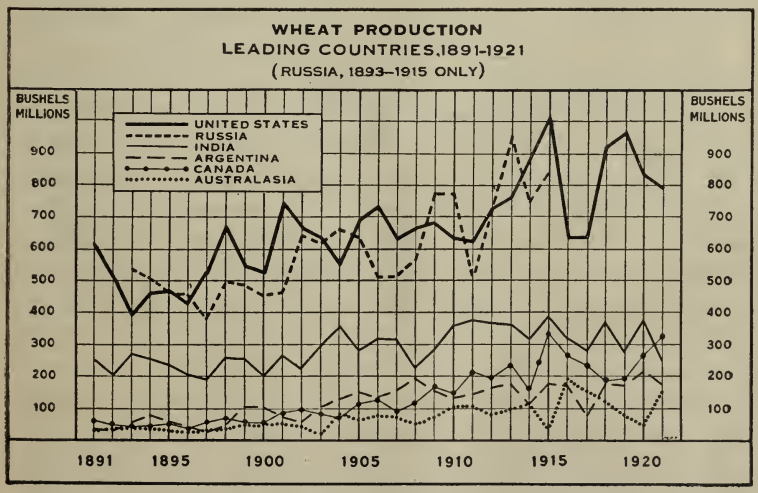


FIG. 5.—Wheat production in the 6 leading countries in the 31 years 1891 to 1921 (Russia 1893 to 1915). The United States and Russia were running a close race before the war. India was easily third until 1921, when Canada jumped into third place. Note the trend of production in each country.

more countries they are likely to be good in other countries, and consequently the world production does not fluctuate as much as production in any one of the important producing countries.

The trend of the world's wheat production is indicated in Figure 4. The trend of production in all the wheat-growing countries taken together was upward until 1915, after which several countries dropped out of the list reporting. The production of countries reporting every year in the period 1891–1921 has increased from about $1\frac{1}{2}$ billion bushels, average for the first three years, to over $2\frac{1}{2}$ billion bushels, average for the last three years.

There was a tendency to increase the production of wheat in all the important surplus-producing countries in the first 20 years of the period 1891–1921 (Fig. 5). Since 1904 the average production of India has not increased, and since 1908 the average production of Argentina has increased but little. The production of Canada continues to increase. War conditions caused an abnormal expansion in production in the United States, reaching its highest point in 1915. It remains to be seen whether the United States will resume an upward trend in production after the normal trade relations have been restored. The trend of production in Russia was continuing upward at about the same rate as in the United States until 1915, the last year for which agricultural statistics are available. The wheat farmers in the United States have much reason to be interested in the prospect of the restoration of normal conditions in Russia and the future trend of production in that country, which is our greatest competitor in the wheat markets of the world (Figs. 5 and 6).

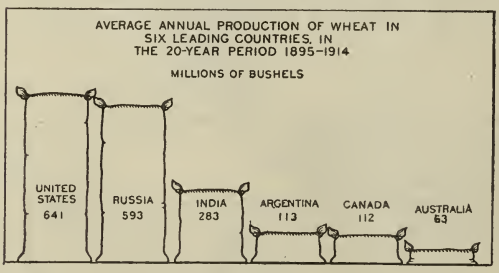


FIG. 6.—Popular presentation of Figure 5 on the wheat production in 6 leading countries.

Wheat Production in the United States.

Trend of Production.

The annual wheat production of the United States has more than trebled in the last 50 years, increasing from about 250 million bushels in the three years 1869–70–71 to over 750 millions in the three years 1919–20–21. As production is the resultant of both acreage harvested and acre yields, both must be examined to find the explanation of this enormous expansion in production (Fig. 7). Between 1870 and 1920 the acreage trebled. The yield per acre also has increased. The increase in production, therefore, has been due largely to expansion of area but partly to increase in acre yields.

As noted above, the increase in wheat production in the last 50 years has been due largely to increase in the area harvested. The increase has not been continuous and regular. Periods of expansion have been followed by a few years of little change or by a slight decline in acreage. Since 1866 there have been three periods of marked expansion, from 1873 to 1880, from 1890 to 1899, and from 1913 to 1919. Will 1921 to 1930 see a repetition of 1881 to 1890, and 1900 to 1910? Perhaps conditions have changed so that history will not repeat itself in this respect.

The rapid rise in acreage and production beginning in 1915 was due, of course, to the demand for wheat caused by the outbreak of the World War. There is a sharp break, however, in the ascending lines in 1916 and 1917. The small decrease in acreage in 1916 was due chiefly to the influence of the enormous production in 1915. The great reduction in production in 1916 was due in part to this reduced acreage but chiefly to the extremely destructive epidemic of black stem rust which occurred that year. The much greater reduction of acreage which occurred in 1917 was due almost wholly to the extraordinary amount of winterkilling, which destroyed 30 per cent of the large acreage of winter wheat which had been sown (Fig. 34). The high peak of acreage reached in 1919, after the war was over, was due partly to the fact that the war was still in progress when the winter

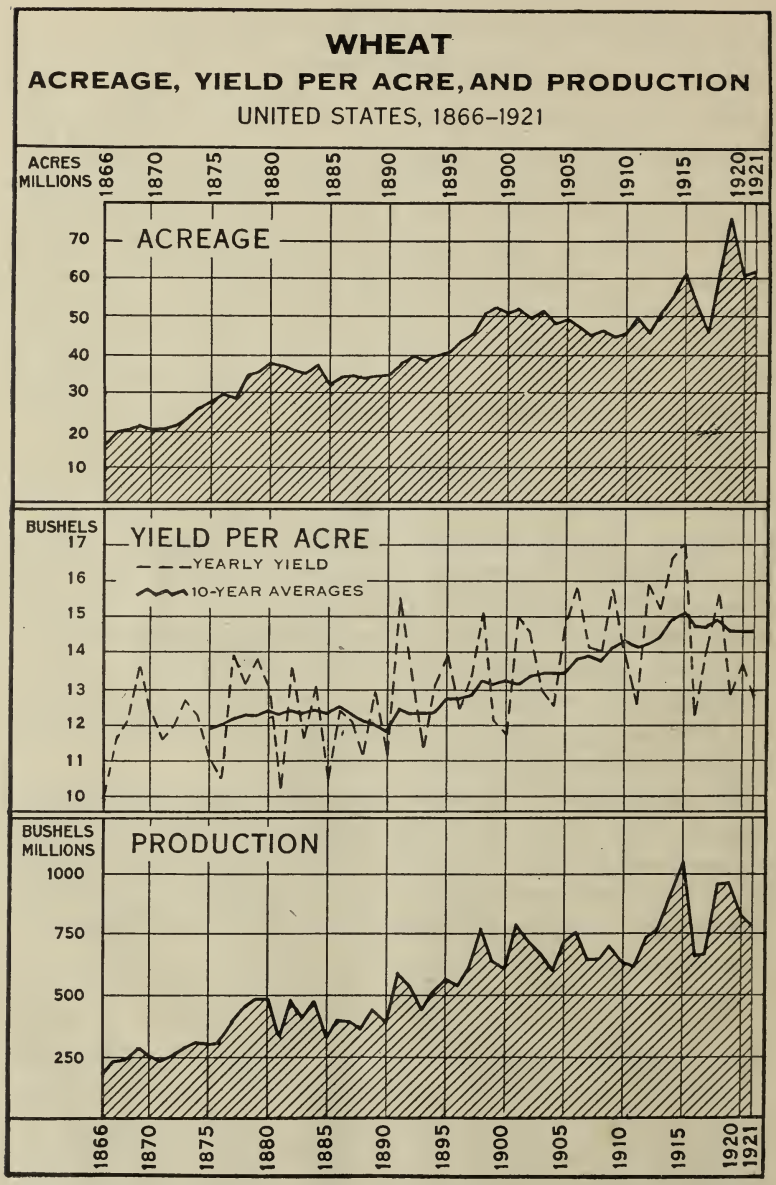


FIG. 7.—Annual acreage, acre yield, and production of wheat in the United States from 1866 to 1921. Estimates of acreage have been revised to accord with census returns. The solid line in yield per acre is a 10-year running average. Note that average yields increased about 3 bushels per acre from 1890 to 1915.

wheat was sown and partly to the attraction of the guaranteed price which was still in effect when the spring wheat was sown, resulting in the large increase in the acreage of both sowings. An explanation of the gradual and general changes in acreages that have occurred will be found in the discussion of the shifts in production, which follows.

In the last three years the acre yields of wheat have been below the average of the last 10 years. Production would have been much larger had the yields in these years equaled the average. The average of yields in the three years 1919–20–21 is only one-half of a bushel above the average of the three years 1869–70–71, but the average acre yield for the 10-year period ending in 1921 is 2½ bushels above the average for the 10-year period ending in 1875. The trend of yields from 1880 to 1890 was downward, from 1890 to 1915 upward, and from 1915 to date again downward.

The increase in acre yields from 1890 to 1915 was due in part to the shifting of areas of production, expanding high-yielding and reducing low-yielding areas. In some parts of the country improved methods and more intensive cultivation increased yields. The downward trend since 1915 is due largely to adverse seasons, but in part to expansion of area to include low-yielding sections, and probably in part to less intensive culture.

Historical Development of Wheat Growing.

Wheat production began on the Atlantic Coast at least as early as 1618 in the Virginia Colony, and moved westward with the advance of settlement. The first great westward shift took place in the period 1783 to 1840. This was the canal-building period, the period of the development of western New York, and the settlement of the eastern Lake Region and the Ohio Valley.

The implements of production in this period were crude and not adapted to wheat growing on a large scale. Much of the seeding still was done by hand. The sickle (Fig. 8) and the cradle (Fig. 9) were used for harvesting, and the flail (Fig. 8) for thrashing. The reaper (Fig. 10) was in process of development, and came into use before the end of the period.

Wheat production, 1839.—The census of 1840 gives the wheat production of 1839 as shown in Figure 11. About half of the wheat was grown east and half west of the Allegheny Mountains. New York, Pennsylvania, Virginia, and Ohio produced 60 per cent of the Nation's wheat. The western frontier takes in parts of Wisconsin, Iowa, and Missouri. The eastern boundary of southern wheat production follows closely the fall line from Virginia south to central Georgia. The western wheat was carried eastward by the Great Lakes and the Erie Canal to New York, or southward by river to New Orleans.

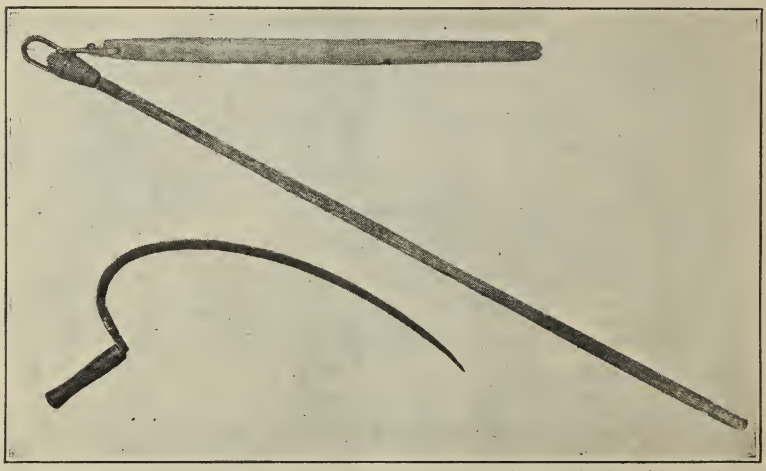


FIG. 8.—The sickle and the flail, used for harvesting and thrashing wheat until well into the nineteenth century.

Wheat production, 1849.—The total production increased but little in the decade 1839–1849 (Fig. 11). New York, Pennsylvania, Virginia, and Ohio remained the leading States. The crop increased largely in Michigan, Wisconsin, and Illinois and declined somewhat in the far East. A beginning had been made in Oregon, Utah, and New Mexico (not shown on the map). Lakes, rivers, and canals were still the important means of transportation, but railroads now extended from lake ports into the interior of two western States, one across southern Michigan, the other across central Ohio from Sandusky to Cincinnati.

FIG. 9.—The cradle, which followed the sickle as an implement for harvesting. It left the wheat in a windrow for the binders.

Wheat production, 1859.—This map (Fig. 12) shows the second great shift in wheat production. Illinois, Indiana, and Wisconsin have become the leading wheat-producing States. The States west of the Alleghenies increased their production from 49 to 119 million bushels, whereas east of the mountains production remained stationary. California and Texas appear on the map for the first time with large crops, California at once taking rank with the leading States. The low production in Ohio and New York in this

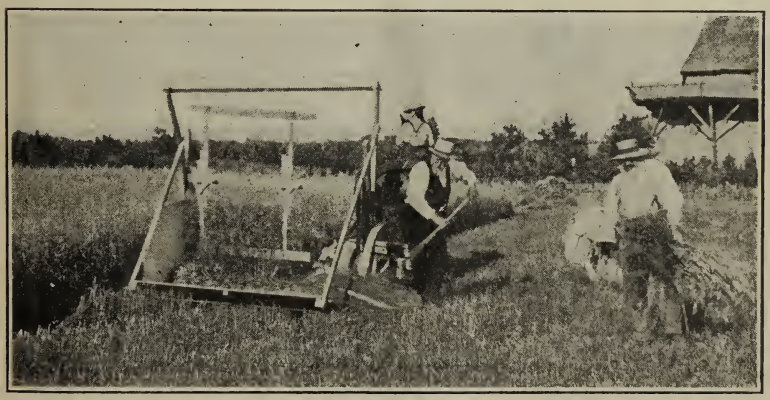


FIG. 10.—Early type of reaper developed about 1830. The grain was raked from the platform by hand. This machine evolved finally into the self-rake reaper still used in this country for harvesting flax and buckwheat.

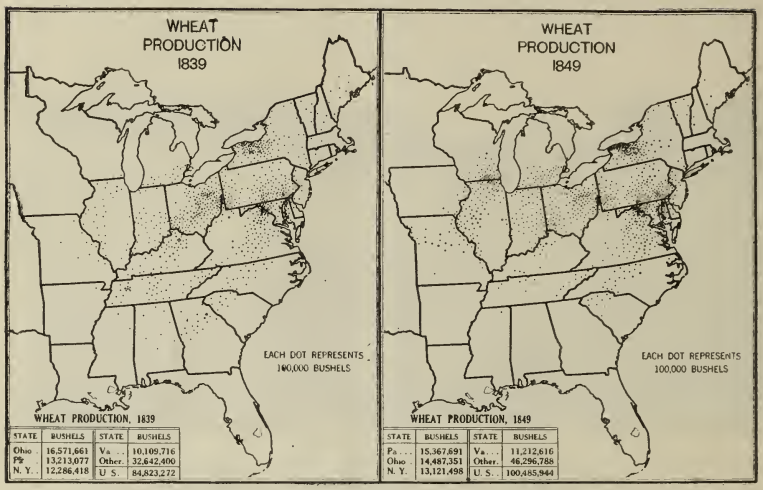


FIG. 11.—Wheat production in the United States in 1839 and 1849. The western frontier crosses the Mississippi River and ascends the Missouri. Transportation was eastward and southward by lake, canal, and river. Wheat growing began about 1838 in the Willamette Valley of western Oregon and increased rapidly after the discovery of gold in California. By 1849 a beginning had been made in Utah and New Mexico. Railroad transportation was extended to Michigan and Ohio and reaping machinery was in use.

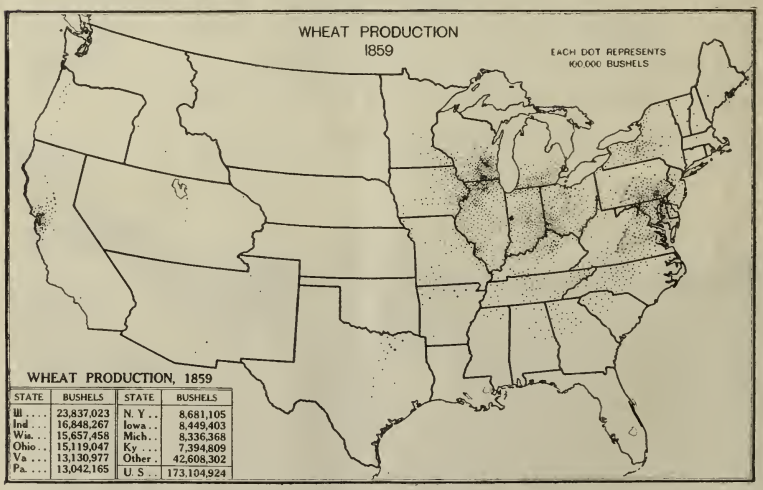
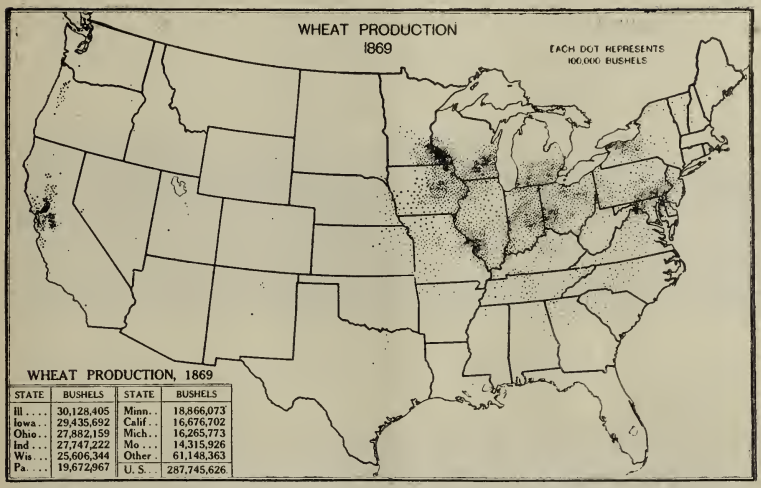


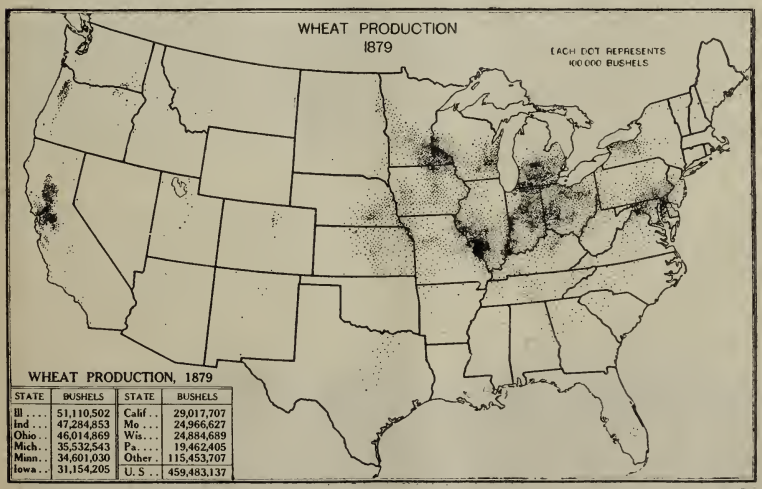
FIG. 12.—Wheat production in the United States in 1859. Wheat growing has advanced into Minnesota, Nebraska, Kansas, and Texas. Production areas appear in territory comprising what is now Arizona, New Mexico, Utah, and Idaho and larger areas in California and Oregon.



WHEAT PRODUCTION, 1869

STATE	BUSHELS	STATE	BUSHELS
Ill....	30,128,405	Minn..	18,866,073
Iowa..	29,435,692	Calif..	16,676,702
Ohio..	27,882,159	Mich..	16,265,773
Ind...	27,747,222	Mo...	14,315,926
Wis...	25,606,344	Other.	61,148,363
Pa....	19,672,967	U. S...	287,745,626

FIG. 13.—Wheat production in the United States in 1869. Production in the east central States and California has increased enormously in the ten years. The frontier advanced but little onto the Great Plains. Small increases occur in the Rocky Mountains and Great Basin, while dry-land production began in eastern Washington.



WHEAT PRODUCTION, 1879

STATE	BUSHELS	STATE	BUSHELS
Ill....	51,110,502	Calif..	29,017,707
Ind...	47,284,853	Mo...	24,966,627
Ohio..	46,014,869	Wis...	24,884,689
Mich..	35,532,543	Pa....	19,462,405
Minn..	34,601,030	Other.	115,453,707
Iowa..	31,154,205	U. S...	459,483,137

FIG. 14.—Wheat production in the United States in 1879. The frontier has moved steadily westward across the prairies with large production in Kansas and Nebraska. Dry-land production in California, Oregon, and Washington increased greatly. Production increased also in Minnesota, southwestern Illinois, Michigan, Indiana, and Ohio.

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FIG. 15.—Three modern self-binders in operation. This invention made possible the great expansion of wheat production on the prairies and plains.

year is due to an unfavorable season. A network of railroads now covers the States of the Central West, drawing wheat from the farms in the hearts of these States.

Wheat production, 1869.—The States west of the Alleghenies almost doubled their production in the decade 1859–1869 (Fig. 13). The most significant feature is the great increase in production in the regions already occupied. The frontier advanced but little. Small beginnings had been made in Colorado, Montana, and eastern Washington. The first transcontinental railway was just completed and other roads had been extended into Kansas and Minnesota. Chicago and Milwaukee had become the great central markets of the near Northwest.

FIG. 16.—The modern grain separator, developed with the self-binder, thrashing wheat from the shock by steam power from a traction engine.

Wheat production, 1879.—While production still increases greatly in the States east of the Mississippi River, the wheat belt moves again steadily westward (Fig. 14). The frontier has now advanced into the Red River Valley, and the Kansas-Nebraska development has well begun, while northern Illinois, southern Wisconsin, and eastern Iowa are declining in production. Minnesota, southwestern Illinois, and a district including southern Michigan, western Ohio, and northern Indiana, have markedly increased their production. Dry-land production increased greatly in the Far West.

FIG. 17,—A large-sized combined harvester-thrasher or "combine," drawn by 32 horses and cutting 30 to 40 acres daily. Smaller sizes are becoming popular and tractors often are used for power. These machines cut and thrash the grain at the same time. These and headers are used under dry-land conditions.

Both acreage and production nearly doubled in the 10-year period, 1870–79. This was due in part to the policy of homestead settlement of public land which followed the close of the Civil War, and partly to the development of machinery which made extensive production possible. The self-binder (Fig. 15), and the large separators driven by traction engines (Fig. 16), played important parts in this expansion of wheat growing. Later the giant combined harvester-thrashers (Fig. 17) served the same purpose in the dry-land areas of the Far West.

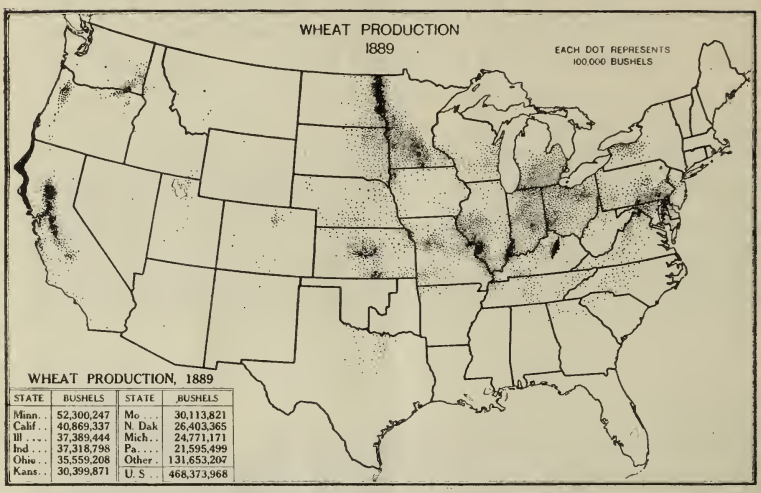


FIG. 18.—Wheat production in the United States in 1889. Production on the prairies and plains of Minnesota, the Dakotas, Nebraska, and Kansas greatly increased, as did also dry-land production in California, Oregon, and Washington. In the Mississippi Valley, except Missouri and southwestern Illinois, there was a marked decrease with a less marked decline eastward to the coast.

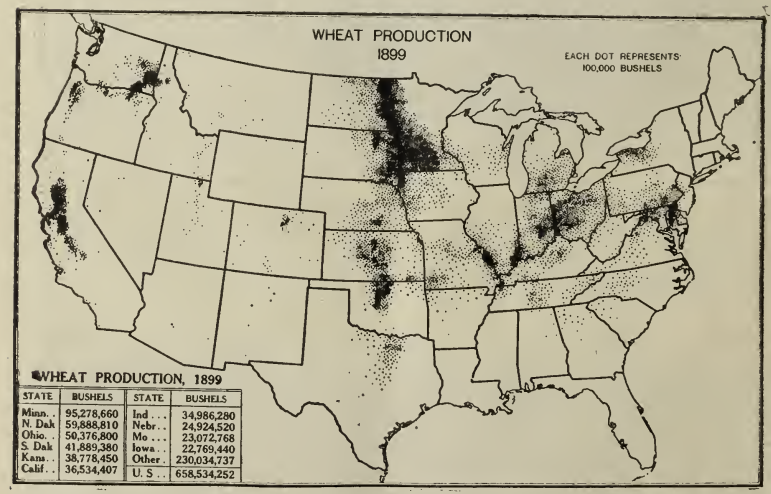
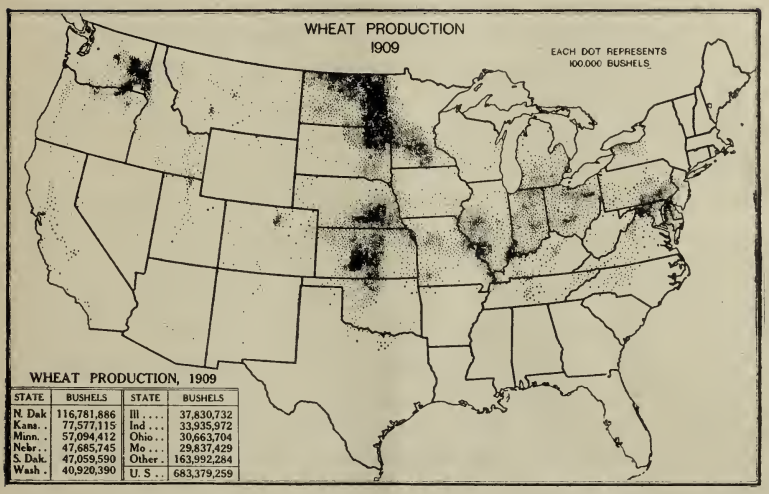


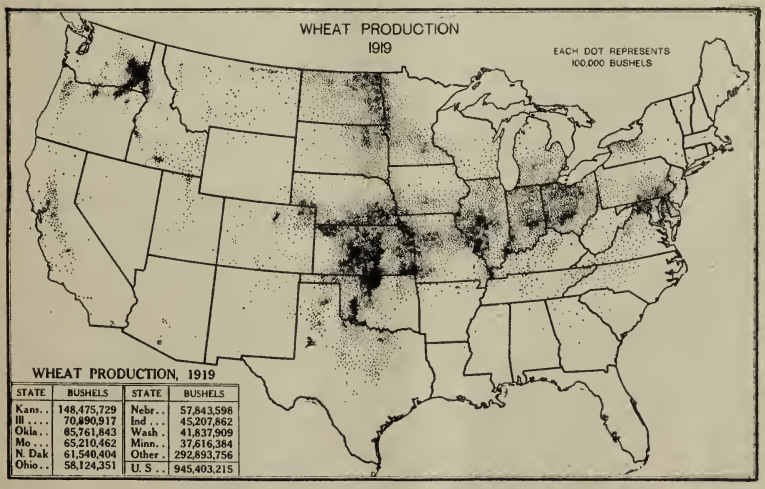
FIG. 19.—Wheat production in the United States in 1899. Enormous expansion of acreage is noted on the prairies in Minnesota and the eastern parts of the Dakotas and on the plains from the Dakotas south to Texas. Dry-land production in Idaho, Washington, and Oregon also is greatly increased. Little change occurs in the East, except in southwestern Illinois.



WHEAT PRODUCTION, 1909

STATE	BUSHELS	STATE	BUSHELS
N. Dak	116,781,886	Ill	37,830,732
Kans . .	77,577,115	Ind	33,935,972
Minn . .	57,094,412	Ohio . .	30,663,704
Nebr . .	47,685,745	Mo . . .	29,837,429
S. Dak.	47,059,590	Other . .	163,992,284
Wash .	40,920,390	U. S . .	683,379,259

FIG. 20.—Wheat production in the United States in 1909. In the hard spring wheat district of the northern Great Plains area and the hard red winter wheat district of the central Great Plains area there is increased production and steady westward movement of production. There is a marked decline in California and some decline in the Ohio Valley.



WHEAT PRODUCTION, 1919

STATE	BUSHELS	STATE	BUSHELS
Kans . .	148,475,729	Nebr . .	57,843,598
Ill	70,890,917	Ind . . .	45,207,862
Okla . .	65,761,843	Wash .	41,837,909
Mo . . .	65,210,462	Minn . .	37,616,384
N. Dak	61,540,404	Other .	292,893,756
Ohio . .	58,124,351	U. S . .	945,403,215

FIG. 21.—Wheat production in the United States in 1919. The stimulus of the World War on wheat production is markedly evident in this year. There was greatly increased production of soft red winter wheat in the central or corn-belt States and of hard red winter wheat in the central section of the Great Plains, but a decreased production of hard red spring wheat in the northern plains because of unfavorable conditions.

Wheat production, 1889.—This map (Fig. 18) reveals another remarkable shift in the wheat belt. The spring-wheat district of the northern Great Plains, the hard-winter-wheat district of central Kansas, and the dry-farmed districts of the Far West show a marked increase in acreage. The upper Mississippi Valley shows a decline just as marked. There also has been a slight decline in the East.

Wheat production, 1899.—The Red River Valley, the Kansas-Nebraska belt, and the Palouse district blacken (Fig. 19). Oklahoma, but recently opened to settlement, produces a large crop. Production in California is beginning to decline. Concentration and intense specialization in certain districts is evident. Minnesota and the Dakotas produce about 30 per cent of the Nation's crop of 658 million bushels. The Minnesota production is greater than that of the entire Nation in 1839, and the Dakota crop is greater than the Nation's crop of 1849.

Wheat production, 1909.—The great wheat belt of the Central West has shifted a little farther west upon the Great Plains (Fig. 20). Minnesota and western Iowa have declined somewhat and the crop of Oklahoma is short, but the crops of Kansas, Nebraska, and the Dakotas have more than doubled. There also has been a large increase in Montana, Idaho, and the eastern Oregon-Washington district. California continues to decline. In the East there is a notable increase in the production of western Illinois, but a decline in western Ohio.

Wheat production, 1919.—The full effect of the World War on wheat production was felt in this year (Fig. 21). The acreage harvested (73,099,421 acres) was 20 per cent greater than in any previous year. The production of 945 million bushels was larger than that of any previous year except 1915, the yield being reduced by unfavorable conditions, especially in June and July. Compared with 1909, the acreage increased 65 per cent, and the production about 40 per cent. Lessened production in the Dakotas and Minnesota was due to the very unfavorable season. In the Corn Belt, Kansas, Oklahoma, Texas, Colorado, and California, production increased very markedly. Kansas alone produced about 15 per cent of the total crop.

Cropping Systems.

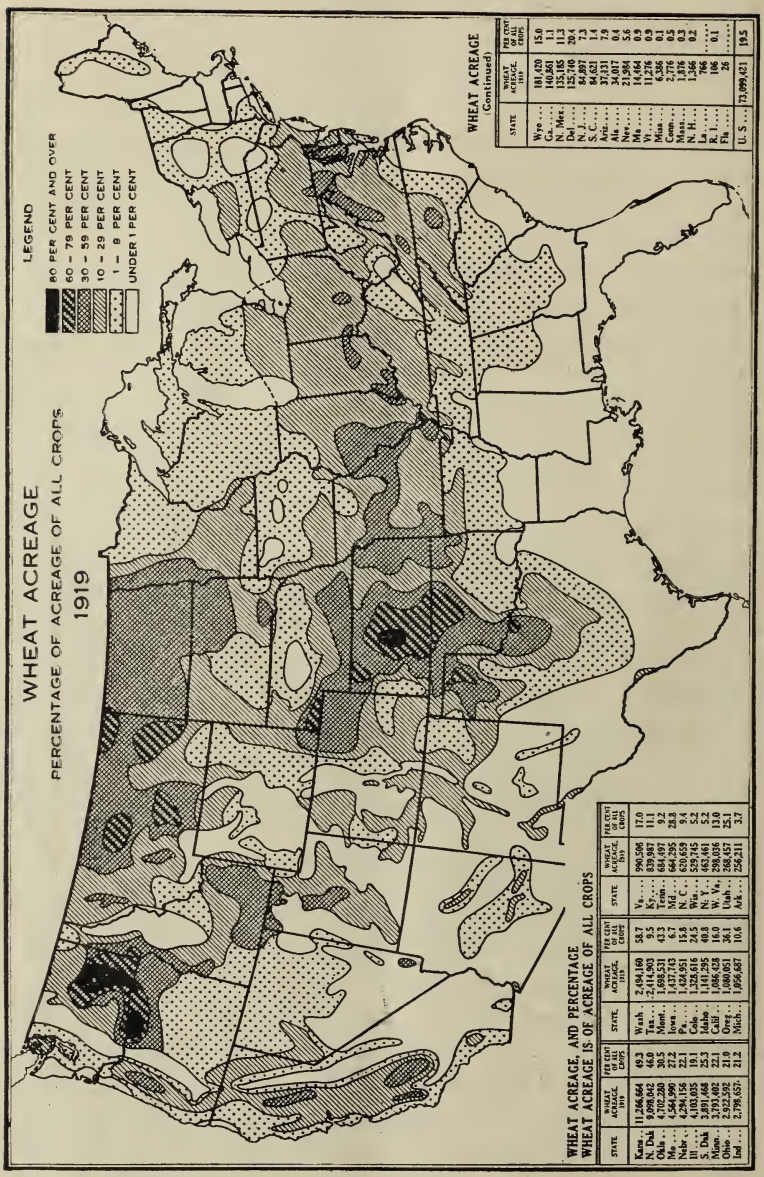
Wheat usually is grown in rotation with other crops, except in certain dry areas where it is alternated with summer fallow. Growing wheat continuously results in depleted fertility and poor physical condition of the soil, increased growth of weeds, accumulation of destructive plant diseases in the soil, and lowered yields of poorer quality. Cost of production also may be increased.

Local conditions determine the rotation and the crops used. A good system for sections having a humid climate should include a legume and a cultivated crop. Cultivation keeps weeds in check and has a beneficial effect upon the soil. Usually the land does not have to be plowed after a cultivated crop, thus reducing the cost of sowing wheat. Legumes add nitrogen and help to maintain the supply of humus. As a rule legumes and grasses are not used in rotations in the Great Plains and other dry-farmed areas because of the difficulty of growing them and of rotting them in the dry soil.

The areas where wheat is now grown in the United States, and the development of the wheat-growing industry in these areas, have been shown in the preceding maps. The relative importance of wheat in these areas and the cropping systems used on the farms where wheat is grown will now be considered. In Figure 22 the solid black spots indicate those areas where wheat occupied 80 per cent or more of the acreage of land in crops in 1919. Decreasing percentages are indicated by gradually lighter shadings.

The areas containing a high percentage of wheat (solid black in Fig. 22) are seen to be the same, in a general way, as the areas of large wheat production, shown by the dots in Figure 21. On careful study it is seen, however, that the percentage of wheat in the total of all crops is higher in certain areas, as, for instance, in Montana, than the frequency of dots in Figure 21 would lead one to expect. This is because few other crops are grown, on account of climatic or other limiting factors, leaving only wheat to occupy the land.

The choice made by farmers in different areas between the different small-grain crops is shown in Figure 23. The map shows the first and second choices in 1919, as indicated



WHEAT ACREAGE AND PERCENTAGE
WHEAT ACREAGE IS OF ACREAGE OF ALL CROPS

STATE	WHEAT ACREAGE, 1919	PER CENT OF ALL CROPS	STATE	WHEAT ACREAGE, 1919	PER CENT OF ALL CROPS	STATE	WHEAT ACREAGE, 1919	PER CENT OF ALL CROPS
Kans.	11,246,664	49.3	Wash.	2,094,160	58.7	Va.	990,596	17.0
N. Dak.	9,098,042	46.0	Tex.	2,414,903	9.5	Ky.	839,987	11.1
Okla.	4,702,280	30.5	Mont.	1,898,511	43.3	Tenn.	684,497	9.2
Minn.	4,064,000	22.2	Iowa	1,877,170	4.7	W. Va.	664,398	35.4
Nebr.	4,294,158	22.1	Pa.	1,624,951	15.8	N. C.	620,659	9.4
Ill.	4,103,035	19.1	Colo.	1,328,616	24.5	Wis.	529,745	5.2
S. Dak.	3,891,468	25.3	Idaho	1,141,255	40.8	N. Y.	463,461	5.2
Mont.	3,322,402	21.1	Calif.	1,000,053	16.0	Wyo.	298,036	13.0
Ohio	2,737,592	21.2	Ore.	1,000,053	16.0	Md.	256,136	13.1
Ind.	2,798,657	21.2	Mich.	1,056,687	10.6	Ark.	256,211	3.7

WHEAT ACREAGE
(Continued)

STATE	WHEAT ACREAGE, 1919	PER CENT OF ALL CROPS
Wyo.	181,420	15.0
Ga.	140,861	1.1
N. Mex.	135,195	11.4
Del.	125,746	20.4
N. J.	84,897	7.3
S. C.	84,621	1.4
Ariz.	37,131	1.9
Alabama	34,101	0.4
Nev.	21,984	5.6
Me.	14,464	0.9
Vt.	11,276	0.9
Mississ.	6,386	0.1
Conn.	2,276	0.1
Mass.	1,876	0.3
N. H.	1,566	0.2
La.	766	...
R. I.	98	0.1
Fla.	26	...
U. S.	73,099,421	19.5

FIG. 22.—Wheat occupies 80 per cent or more of the crop land in parts of central western Kansas and eastern Oregon and Washington, and more than 60 per cent in larger portions of the same States and of Montana, Nebraska, Oklahoma, and Texas.

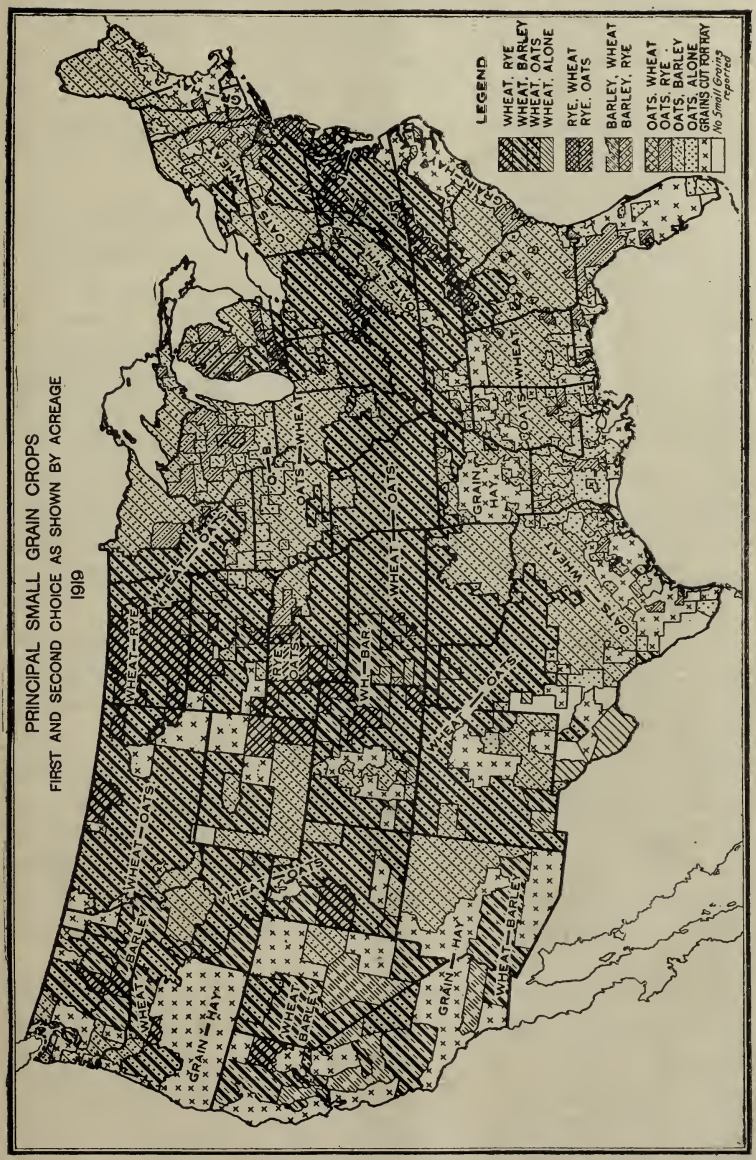


FIG. 23.—In most of the wheat-growing regions of the United States wheat leads in acreage with oats second. In the Dakotas and part of Montana rye stands second. Oats leads wheat in the South, in New England, in the northern Corn Belt, and under irrigation in some parts of the Rocky Mountain region.

by the acreage of the two most important small-grain crops. The crop with the largest acreage in any area is named first, followed by the crop next in importance. The choice of crops thus shown is the result of the interaction of all the various climatic, biologic, and economic factors affecting production on the farm. Some of these factors will now be discussed more fully.

The effect of climate on the distribution of different crops, and different kinds or classes of each crop, is very important. The distribution of winter wheat and spring wheat, for example, is shown in Figures 24 and 25. Winter wheat is grown south of the spring wheat area, except in certain areas where either type may be grown. Winter wheat almost always is preferred where winter conditions permit it to be grown, as it usually gives a higher yield and does not compete so much with spring-sown crops for labor as does spring wheat. In a locality growing both types the winter wheat is ready to harvest earlier than is spring wheat, thus extending the harvest season and allowing a better utilization of labor.

The different characteristics of different crops enable the farmer to utilize his labor to the best advantage and avoid the employment of much extra labor. In the spring-wheat belt, for instance, wheat is sown first in the spring, early sowing being very advantageous to this crop. After wheat comes the seeding of oats and barley, and in some localities, flax or corn. The harvest of barley comes first, followed by that of wheat and oats. Rye finds a place in the agriculture of the spring-wheat belt when prices are attractive. This crop, being fall-sown, gives a better distribution of labor than with spring-sown crops alone.

Not only does the adaptation of crops to different areas determine what ones are grown in any particular place, but among the adapted crops their relative profitableness is a factor of importance. The principal crops competing with spring wheat are oats (Fig. 26), barley (Fig. 27), and, to some extent, winter rye (Fig. 28) and corn (Fig. 29), while those competing with winter wheat are principally oats and corn. Oats can be grown over all the area where wheat is adapted, barley over the area suited to spring wheat, and corn over a large part of the winter-wheat area and a small part of the spring-wheat area. (See Figs. 30, 31, and 32.)

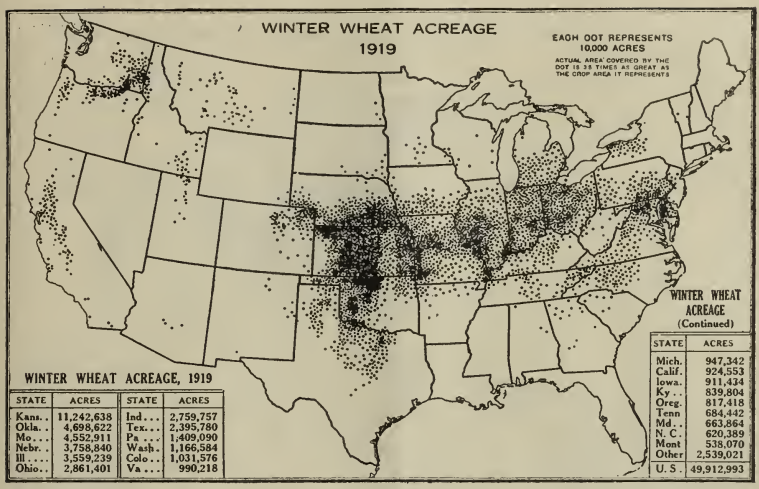


FIG. 24.—Nearly all of the winter wheat is grown between latitude 35 and latitude 41, except in the Pacific Northwest, where the climate is milder. The northern frontier line of winter wheat follows in a general way the mean winter temperature line of 20° F., which extends in a northwesterly direction from southern Wisconsin and northern Iowa diagonally across South Dakota and Montana.

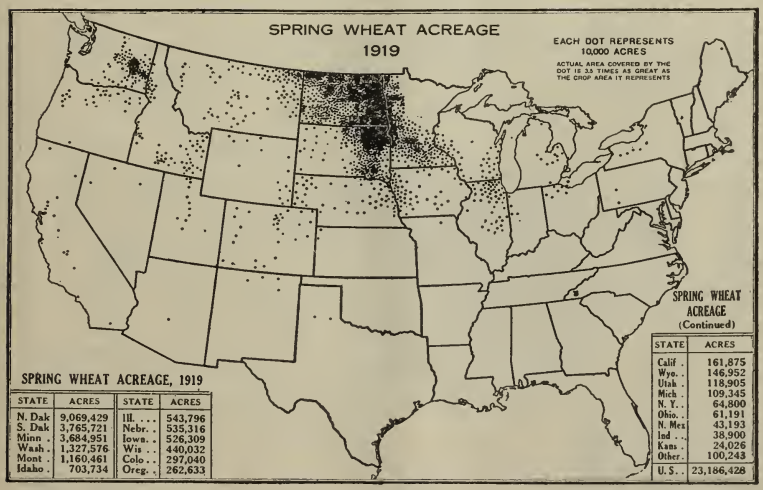


FIG. 25.—Practically all of the spring wheat is grown from latitude 43 northward, the boundary of the area crossing our boundary at latitude 49 and extending far into Canada. Spring wheat lies north of corn and winter wheat. The northern limit of spring wheat is approximately the mean summer temperature of 58° F., which is found in the United States only in the western mountains.

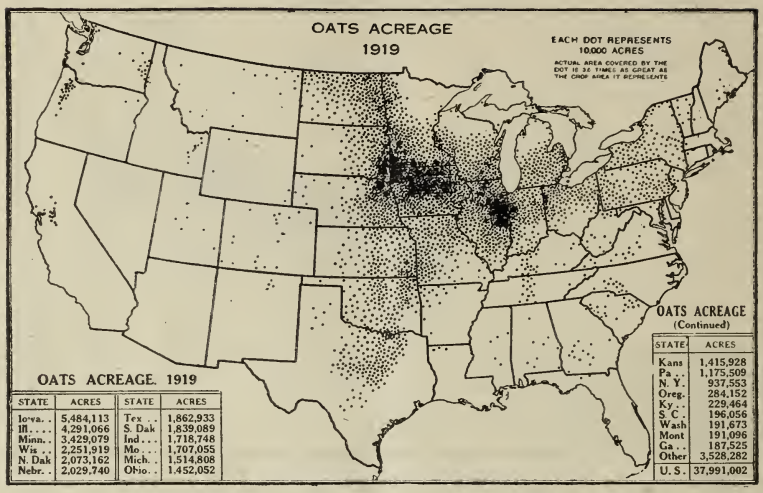


FIG. 26.—The oat crop is less subject to disease than wheat and can be grown under a wider range of environing conditions. Winter varieties are grown only in the South. Spring oats on wheat farms permit better distribution of labor in seeding and harvest. Concentrated production is adjacent to great central markets and between the winter and spring wheat belts.

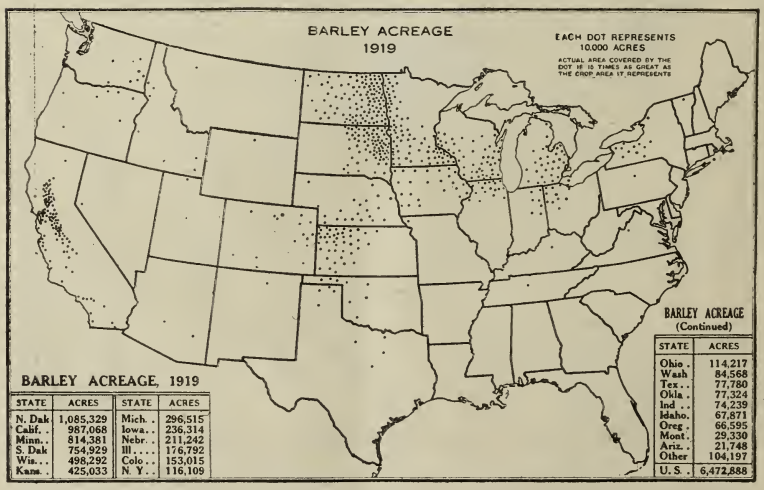
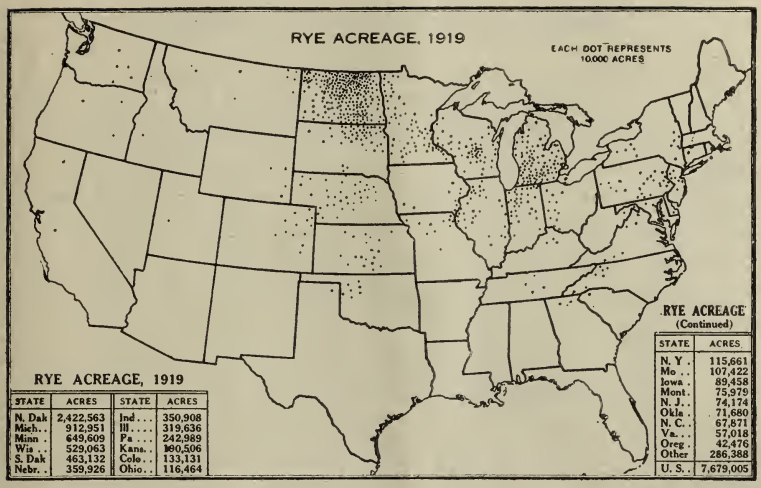


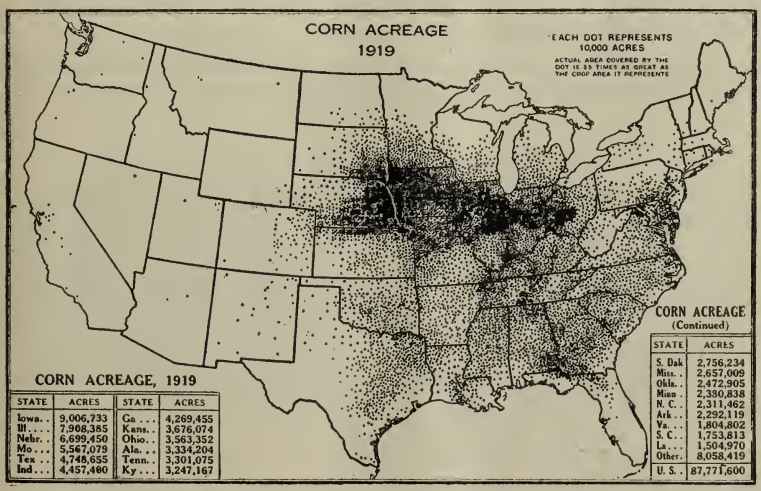
FIG. 27.—Spring barley is well adapted in the spring-wheat belt. It can be sown later and harvested earlier than spring wheat or oats and provides feed grain for stock. A little winter barley is grown in the South.



STATE	ACRES	STATE	ACRES
N. Dak	2,422,563	Ind...	350,908
Mich..	912,951	Ill....	319,636
Minn .	649,609	Pa ...	242,989
Wis ..	529,063	Kans..	190,506
S. Dak	463,132	Colo..	133,131
Nebr..	359,926	Ohio..	116,464

STATE	ACRES
N. Y .	115,661
Mo ..	107,422
Iowa .	89,458
Mont.	75,979
N. J..	74,174
Okla .	71,680
N. C..	67,871
Va...	57,018
Oreg.	42,476
Other	286,388
U. S..	7,679,005

FIG. 28.—Rye is practically all fall sown. It competes successfully with winter wheat on poor soils, and with spring wheat because it permits a better distribution of labor throughout the year. This explains its extensive production in North Dakota, where spring wheat is the dominant crop, and winter wheat can not be grown.



STATE	ACRES	STATE	ACRES
Iowa..	9,006,733	Ga ...	4,269,455
Ill ...	7,968,385	Kans..	3,676,074
Nebr..	6,699,450	Ohio..	3,563,352
Mo...	5,567,079	Ala...	3,334,204
Tex ..	4,748,655	Tenn..	3,301,075
Ind...	4,457,490	Ky...	3,247,167

STATE	ACRES
S. Dak	2,756,234
Miss..	2,657,009
Okla..	2,472,905
Minn .	2,380,838
N. C..	2,311,462
Ark ..	2,292,119
Va...	1,804,802
S. C..	1,753,813
La...	1,504,970
Other.	8,058,419
U. S..	87,777,600

FIG. 29.—Corn is widely grown under warm humid and semiarid conditions. Concentrated production in the corn belt is the basis of hog and cattle feeding. As a late-sown tilled crop, wherever grown, it enables weed control, better rotations, diversified farming, including stock raising, and better seasonal labor distribution. It also is the dominant silage crop for dairy and beef production.

Organization for Profitable Production.

Most of the wheat farming in this country lies between the Corn Belt and the ranching regions of the West. The reactions which occur between these general classes of farming lead many observers to look upon corn farming as encroaching upon wheat farming and to look upon wheat farming as encroaching on the ranching area. The relative profitableness of the different crops which are grown in any given place at any given time is influenced by a wide range of conditions.

The present yields of wheat in Iowa, for instance, are good. If wheat paid better than corn under conditions such as prevail in Iowa (Fig. 30), farmers there would center their business on wheat rather than on corn as at present. Much of the world, however, is well suited to wheat production, while relatively only a small part of it is well suited to corn production. It hardly can be expected, therefore, that the price of wheat through any considerable period of time will remain so high in relation to the price of corn as to make wheat a more profitable crop than corn under the best of Corn Belt conditions.

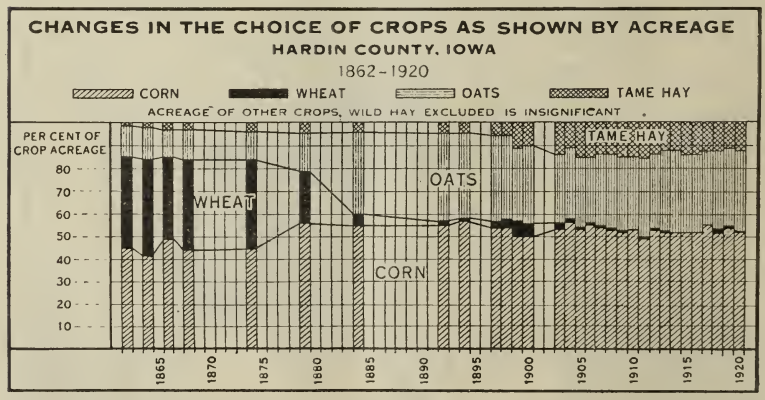


FIG. 30.—In the 10 years from 1875 to 1885 wheat nearly disappeared from Hardin County, Iowa, being replaced chiefly by oats, which in turn was partly replaced by hay as dairying increased. Wheat and oats are much alike in their requirements throughout the season, and competition between them usually is strong. In the past 40 years the purchasing power of oats, in terms of wheat, has increased rather steadily in Iowa. This change in relative prices, carrying weight in a complex of factors, helped oats to supplant wheat.

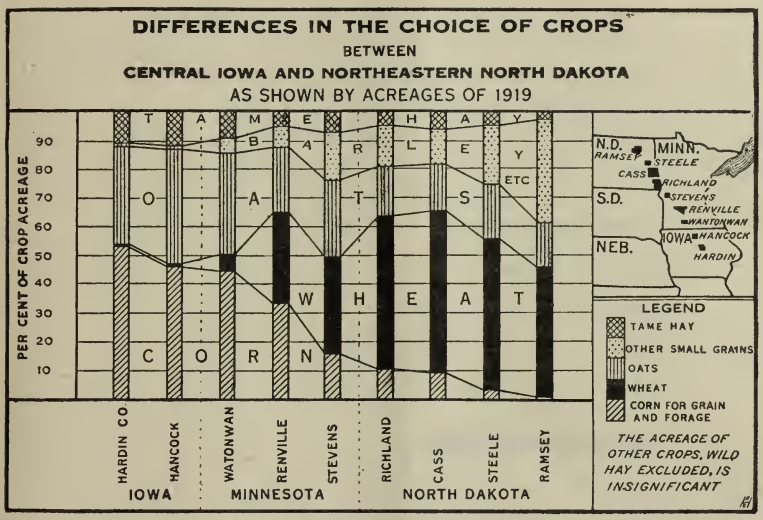


FIG. 31.—In a cross section of the spring-wheat belt, northwestward from north central Iowa to northeastern North Dakota, the proportion of wheat rapidly increases, largely replacing corn, which almost vanishes because of increasing climatic handicaps. The proportion of oats and tame hay slowly decreases, and the proportion of other small grain, principally barley and flax, increases.

There are many other factors which govern the proportionate acreage of different crops in any given section (Figs. 31 and 32). One of the most important factors is the economical distribution of labor on the farm throughout the year. In considering competition between crops for land, therefore, we must not overlook the fact that the farmer in adjusting his business weighs the different possible uses and requirements of labor (man labor) and equipment (horses, cattle, machinery, fences, etc.) with the different possible uses and requirements of land. Thus, even though he is situated where wheat is the one single crop which pays best, he is not likely to grow wheat alone, because usually the profitableness of the farm as a whole will be increased by producing some other crop for sale or for home use.

He gives a share to corn or to some other tilled crop, partly because rotation with a tilled crop is desirable to clean the land of weeds and partly because it utilizes labor and equipment to better advantage in handling the crops and also favors live-stock production. Likewise he gives a share to other cereals or to hay crops, which can be grown,

harvested, fed, and marketed, for the most part, without seriously interfering with giving attention to wheat, and a share to native or to tame pasture for live stock which will utilize hay and other feeds during the winter.

Just as farmers in a wheat area usually can gain by allotting a share of wheat land to crops that will give a return on labor and equipment at times when wheat is not demanding attention, so farmers in the Corn Belt usually can gain by allotting a share of corn land to small grain, hay, and pasture which will give a return on labor and equipment at times when corn is not demanding attention (Figs. 30, 31, and 32).

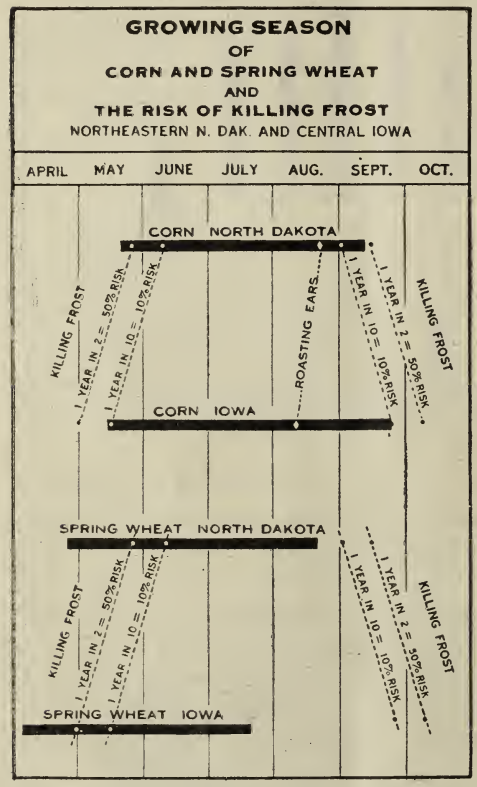


FIG. 32.—Northward from central Iowa to northeastern North Dakota early fall frosts become a greater and greater handicap to corn but not to wheat, and they are the largest single factor in decreasing corn acreage.

So, whether the farmer is choosing wheat as a main crop or as a subordinate crop, he chooses it on the basis of how profitable it is in relation to other crops, from the standpoint of the use of labor and equipment as well as land, in one year or in several years. Regardless of how important or how unimportant wheat may be in his business, his aim is to press it at the expense of other things only so far as he believes it will pay best.

Natural Factors Influencing Production.

The production of wheat in any year is the result of the interaction of many factors in nature, some favorable, others unfavorable. The most important of these are the climatic conditions. Too much or too little moisture, and the occurrence of frost and freezing temperatures, hail, hot winds, and storms take their toll from the wheat crop. Fungous diseases and insects and animal pests exact further tribute.

Moisture.—The dependence of the wheat crop on precipitation, that is, on rain and snow, is realized when it is remembered that the great wheat-producing areas of the country

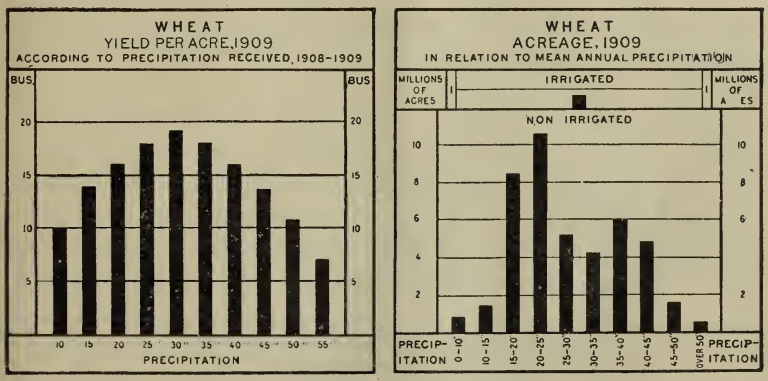


FIG. 33.—In 1909 wheat yields increased with precipitation since the previous crop, until 30 inches had been received, after which there was a gradual decrease in acre yield with increasing rainfall. In the same year nearly one-half of the wheat acreage was in areas having a mean annual precipitation of 15 to 25 inches.

are in the drier portions. In 1909 it was determined (Fig. 33) that over 60 per cent of the wheat acreage and production of the United States was in regions (nonirrigated) having less than 30 inches of annual precipitation. It also was determined that largest yields were harvested in that year in regions where the precipitation was 30 to 35 inches, with lower yields where precipitation was either more or less. The size of the wheat crop, then, must depend every year to a very large extent on the precipitation, as usually this is the limiting factor.

Fortunately, not all parts of the country are liable to extensive damage in any one year. Dry weather often is

prevalent over large areas, but it has never been sufficiently widespread to reduce the wheat production of the country as a whole to conditions of famine, as was the experience in Russia in 1921.

Winter-killing.—Some of the winter wheat acreage sown in the fall always is abandoned the next spring. This is due to several unfavorable weather conditions during fall and winter, such as fall drought, intense cold, winter drought, soil blowing, ice sheets, etc., collectively known as winterkilling. The percentage of the acreage sown that was abandoned in the different years from 1900 to 1921, inclusive, is shown in Figure 34. The largest abandonment was 31 per cent in 1917, after very unfavorable winter conditions, and the smallest was 1.1 per cent in 1919. The average for this period is about 10 per cent.

Insects.—Severe losses of wheat are caused each year by insects. Most important of these are Hessian fly, chinch bug, joint worm, grasshopper, and green bug. The average losses due to these pests have been estimated at more than 2 per cent of the crop, or nearly 18 million bushels each year. The Hessian fly is responsible for more than half of this loss.

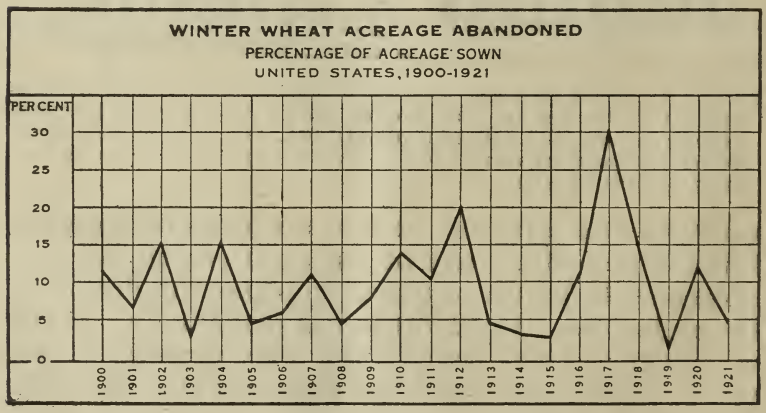


FIG. 34.—Every spring a considerable acreage of winter wheat sown in the previous autumn is abandoned because of winter injury from various causes. The average abandonment is about 10 per cent, but occasionally it is much larger, rising to 20 per cent in 1912 and 31 per cent in 1917.

The area infested by the Hessian fly is shown in Figure 35, together with best dates for seeding wheat to escape injury.

Chinch bugs are very destructive in some years in the central part of the country, and farmers often are put to great expense in fighting them. The joint worm is a serious pest, principally in the States north of the Ohio River.

Grasshoppers, in the spring-wheat area and in Kansas, sometimes are very destructive, especially in dry years. In Texas, Oklahoma, and Kansas the green bug occurs in destructive numbers in certain favorable years and causes considerable losses, but, on the average, such losses are not more than 5 per cent of those caused by Hessian fly.

FIG. 35.—In the area infested by Hessian fly, wheat seeding must be delayed until the adult flies have died or severe injury may result. This fly-free date may be later than the most favorable date for seeding wheat from other viewpoints.

Fungous diseases.—Wheat is subject to many fungous diseases, chief among which are stem rust, leaf rust, stripe rust, bunt or stinking smut, loose smut, and scab. Of these, stem rust, bunt, and scab are of greatest economic importance and are widely distributed throughout the chief wheat-producing areas. Estimates of losses, in bushels, caused by these three diseases, made in the four years from 1918 to 1921, inclusive, are as follows:

Disease.	1918	1919	1920	1921
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*
Stem rust	804,000	71,417,000	54,903,000	22,800,000
Bunt	19,063,000	10,219,000	14,088,000	10,500,000
Scab	3,936,000	59,680,000	11,724,000	10,000,000
Total	23,803,000	141,316,000	80,715,000	43,300,000

In severe epidemics the losses caused by stem rust alone sometimes amount to more than those caused by all other diseases combined. In 1916, this rust destroyed approximately 180,000,000 bushels of hard red spring wheat in the United States and about 100,000,000 bushels in the Prairie Provinces of Canada. In Denmark, stem rust has been effectively controlled by eradicating the common barberry, which carries one stage of this rust. The United States Department of Agriculture and 13 North-central States are now cooperating in a campaign to eradicate this barberry in those States.

Of these three diseases, bunt is the only one that can be controlled by seed treatment. Formaldehyde and copper sulphate (blue vitriol) are now widely used for the prevention of bunt. In the Pacific Coast States, where so much injury has been caused by formaldehyde, the blue vitriol-lime method is used, the seed being dipped in milk of lime immediately after treatment.

Scab is a widely distributed disease of wheat, which frequently attacks barley and rye also. It is particularly abundant in the Corn Belt. It is caused by the same fungus (*Gibberella saubinetii*) that causes much of the root, stalk, and ear rot in corn. This disease usually is more destructive in sections where wheat follows corn in the rotation. Effective methods for the control of scab have not yet been discovered.

Cost of Production.

The farmer is concerned first of all with the efficient production of crops and live stock. This purpose may most readily be attained by studying the production costs of the various crop and live-stock enterprises which make up his farm business. A knowledge of the separate factors which make up the total cost of farm enterprises is necessary in order to know where and to what extent efficiency in production may be introduced. Knowing the relative costs and profits of the several farm enterprises, the farmer is in position to select the most profitable ones, thereby increasing the total net profits of the farm. A study of production costs, in addition to supplying information for the introduction of more efficient methods and for the basis of enterprise selection, also serves the useful purpose of comparing the production cost with market prices, such comparisons being necessary if the farmer is to be alert in adjusting the supply to the demands of the market. Areas in which studies have been made are shown in Figure 36.

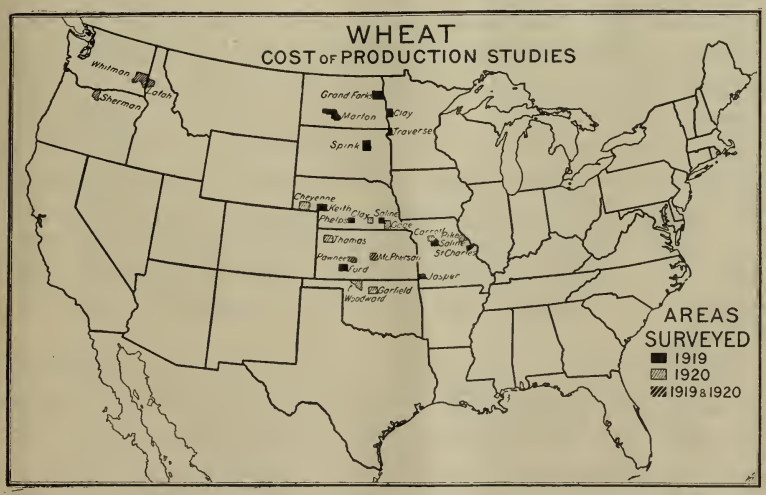


FIG. 36.—Studies of the cost of producing wheat on representative farms were made by the Office of Farm Management and Farm Economics for the crops of 1919 and 1920 in the counties shown on this map. The results of the study of the 1919 crop are used as a basis for this discussion. For complete report see Department Bulletin 943. Write the department for results of 1920 study.

Variations in Cost of Production.

There are very few farms on which wheat is produced where the conditions are exactly alike throughout. The different possible combinations of variable factors are almost infinite in number, and there is a wide range in the cost per acre and the cost per bushel (Fig. 37). This means that whatever figure is decided upon as "the cost of producing wheat," most of the farms produce at some other figure, some below and some above. No further argument than the great variety of different costs on different farms should be required to prove that the price of wheat is not influenced by the cost of producing wheat, except in a remote way and only as the result of a series of adjustments. The farmers' interest, therefore, is in the *cost of production for his farm*, its relation to the market price offered to *him*, the interrelations of the several factors of cost *on his farm*, whether he can afford to produce wheat at the probable price, and how and where *he* can cut *his* expenses or increase *his* returns.

The actual figure determined upon, to represent the average cost of production, is of use, in *connection with other statistics*, for guiding judgment as to production and marketing, adjustments being indicated to producers and to consumers through price. If the supply is large the price will be low, and producers will tend to produce less wheat the next year. Any call for more wheat must be made with a promise of a higher price. The actual cost figure arrived at is not so important, either to consumer or producer, as the measurement of the conditions which determine the figure and an understanding of the trend of changes in cost factors and in prices, and their effect, combined, upon production.

It obviously is impossible for any agency to determine the cost of producing wheat for every farm on which wheat is produced. It is quite possible, however, to study the cost of producing wheat on a number of representative farms in important producing sections where different conditions prevail, with confidence that the data so obtained will approximate very closely the results which a study of every farm would reveal. Sufficient variations of conditions are brought to attention in this way to enable each producer to estimate his own cost of production with a minimum of

effort by the very simple process of comparing notes on his own farm operations with those of the tables and charts published in reports.

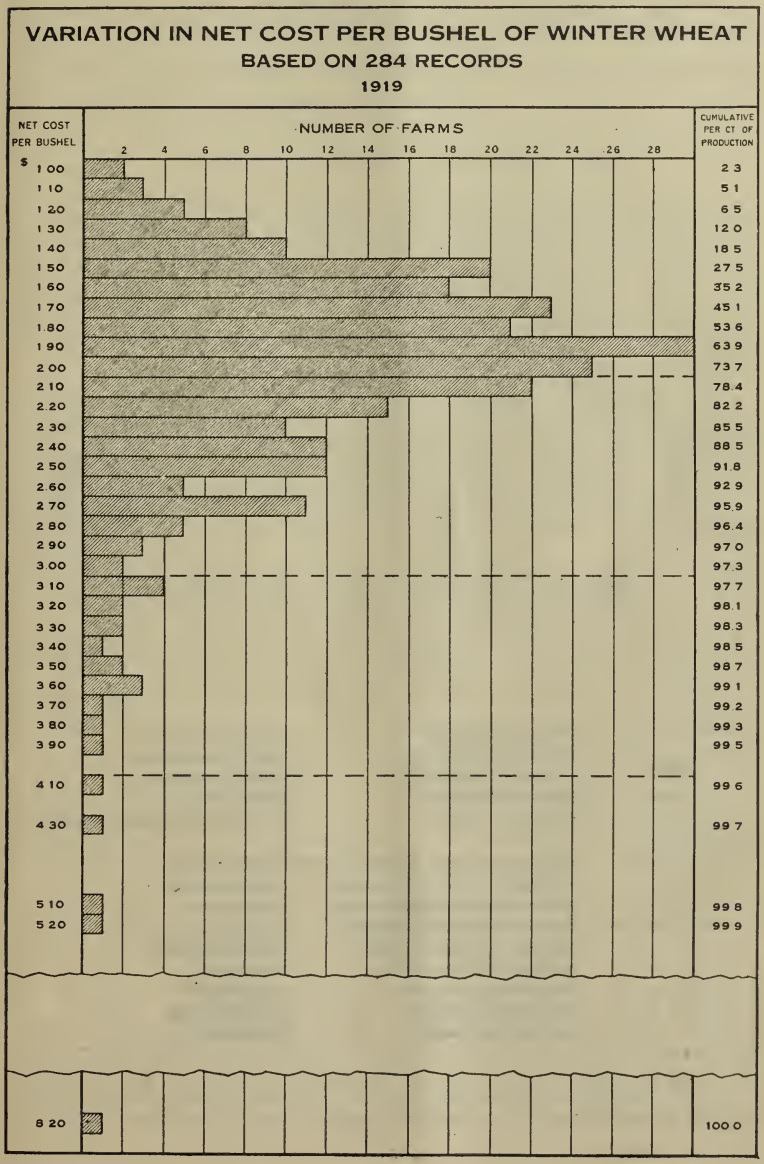


FIG. 37.—Note the wide variation in the net cost per bushel in 1919. The average cost per bushel on these 284 farms was $1.87. About three-fourths of the farmers of whom records were taken produced wheat at a cost of $2 and less.

Regional Variation in Cost of Production.

Next to the wide variation in net cost per bushel, the outstanding fact is that high cost per acre does not necessarily mean high cost per bushel. In fact if we know only the cost per acre we know very little about the cost of a bushel of wheat. This fact is illustrated graphically in Figure 38. The average cost per acre of producing winter wheat in Saline County, Nebr., was just twice as high in 1919 as the cost of growing an acre of spring wheat in Morton County, N. Dak., but the net cost per bushel of the winter wheat in Saline County, Nebr., was only 6 cents more than half the cost of a bushel of the spring wheat in Morton County. Similar differences, even though not so marked, may be observed in acre and bushel costs of other areas.

The dominant factor is acre yield. The average yield of spring wheat in Morton County, N. Dak., in 1919 was 4.4 bushels per acre, while in Saline County, Nebr., the yield of winter wheat was 18.1 bushels per acre. Neighboring farms with about the same cost per acre may show very

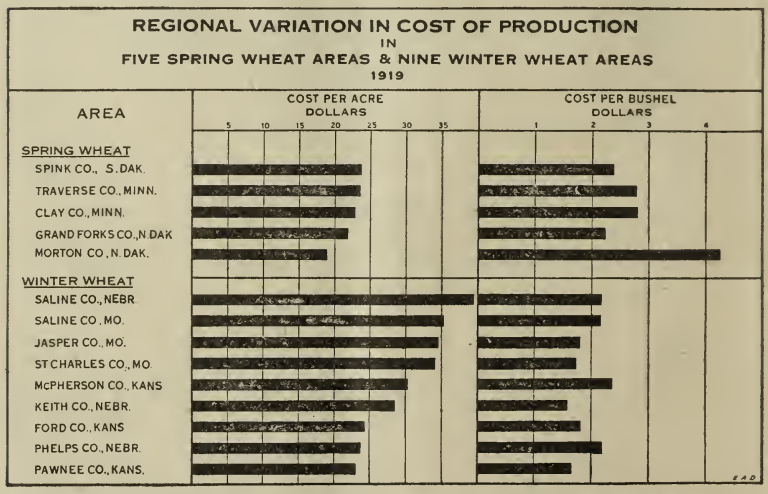


FIG. 38.—Note low cost per acre but high cost per bushel in Morton County, N. Dak., and high cost per acre but low cost per bushel in Saline County, Nebr. Yield per acre is an important factor in cost per bushel.

different costs per bushel. Take for instance two farms in Morton County, N. Dak., each harvesting 100 acres of spring wheat, and by no means extreme cases for the season. On one of these farms with a yield of 5 bushels per acre, the acre cost was $21.31, and the bushel cost $4.30. On the other farm with a yield of 2.9 bushels and a lower acre cost of $19.97, the cost per bushel was $6.79.

Regional Variation in Cost Factors.

As products are sold by the unit, every effort must be made to cut the cost of the unit to the lowest possible figure, irrespective of the acre costs. In the case of wheat, it is particularly necessary to control the unit costs because yield is so much a matter of seasonal variation. All that can be done toward making ends meet is to cut the acre costs to a figure such that over a period of years the returns will be favorable. To do this, one must know from experience what yield one may expect from one's own farm, and keep the acre cost within the figure which, divided by the yield, will give a bushel cost below the selling price. This is much easier said than done, it is true, but with careful attention to the details of sound management, much can be done to reduce the risk of loss and to increase the chances of profit.

The average cost per acre, distributed into six classes of expense, as noted for the 1919 crop, is shown by counties in Figure 39, arranged in descending order of total cost per acre for the five spring wheat areas and for the nine winter wheat areas. The length of the bars is proportional to the average cost for all the farms in each area. The numbers in the columns to the left of the bars show the number of hours of labor used per acre on those farms using horses only; 121 farms using tractors or motor trucks were omitted in figuring the hours of man and horse labor used.

There is wide variation in the amount of labor required per acre, both as between areas and as between different farms in the same area, and some difference in the cost per hour. In the spring-wheat areas the largest number of farms required from 6 to 10 hours of man labor and from

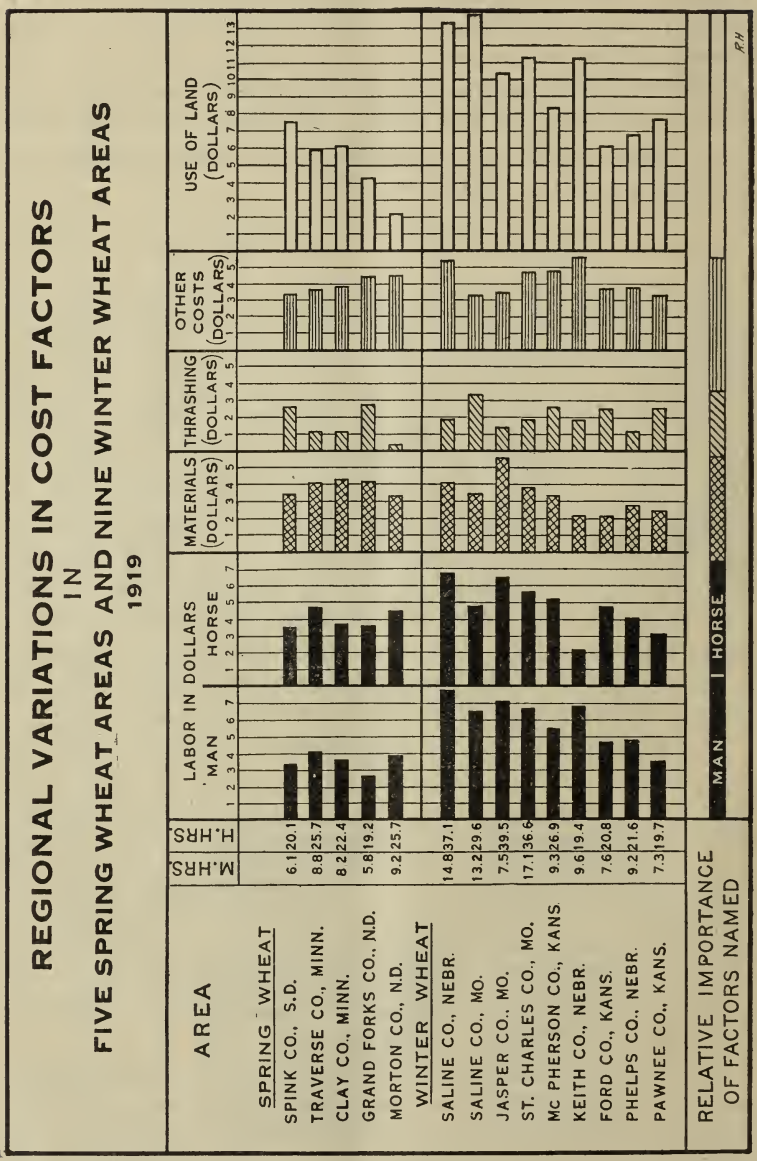


FIG. 39.—The counties in each group are arranged in descending order of total costs per acre. Note the wide variation in the costs of the several factors. For example, the average cost of man labor on an acre in 1919 varied from $2.50 in Grand Forks County, N. Dak., to over $7.50 in Saline County, Nebr.

20 to 26 hours of horse labor. The cost per hour was 35 cents for man labor and 20 for horse labor, except during the harvesting and marketing season, when a rate of 60 cents an hour for man labor prevailed. The lowest labor requirements were 3.6 man hours and 13.4 horse hours on one farm. The highest was 19.1 man hours and 45.8 horse hours, also on one farm.

In the winter-wheat areas seven farmers produced the crop with 5.4 hours of man labor and 15.9 horse hours. On the other end of the scale two farms with a small acreage spent 27.4 man hours and 61.6 horse hours on the acre. Two thirds of the acreage was worked with 10 hours or less of man labor and an average of less than 23 horse hours. The prevailing rates for man labor were from 25 to 35 cents an hour for seed-bed preparation and seeding and 60 to 80 cents for harvesting and marketing. Horse labor cost from 18 cents an hour in Missouri to 25 cents in Ford County, Kans. Together man and horse labor made up nearly 35 per cent of the total cost per acre.

Under the general head "materials" are included seed, twine, manure and straw, green manure, commercial fertilizer, and poison for grasshopper control. Of these, seed cost was most important, at $3.21 for spring wheat and $2.18 for winter wheat. The use of the other items was not general, except binder twine in three spring-wheat and four winter-wheat areas, where all wheat was cut with a binder at an average cost of 51 and 68 cents, respectively. The use of commercial fertilizer was confined almost exclusively to Jasper County, Mo., where it averaged about $2 per acre.

The thrashing cost was variable, depending on the proportion in which the thrashing crew was furnished by the farmer or the thrasherman, and somewhat, of course, on the yield. The cost per acre for thrashing spring wheat was 52 cents less, but 4 cents a bushel more, than for thrashing winter wheat.

The "other costs" include taxes and insurance, use-cost of tractor, use-cost of other farm machinery, loss on abandoned wheat acreage, sack rent, and general expense. The last mentioned was found to be about 12 per cent of the combined cost for labor materials and thrashing. Tractor and machinery use-cost varied, but averaged $1.77 for spring

wheat and $1.86 for winter wheat acreage. Taxes varied from 25 to 95 cents an acre. Small credits for pasture were found in the winter wheat areas and deducted from the total of "other costs."

Use of land was the largest single item of cost in all areas except Morton County, N. Dak. It is determined for cash-rented farms by the rent per acre, for share-rented farms by the quantity of wheat given as rent times the selling price per bushel, and for owned farms by the valuation of the land times the interest rate on first mortgages. The lowest use-cost of land observed was $1.25 an acre cash rent in Morton County, N. Dak. The value of owned wheat land in that county averaged $36. The highest use-of-land cost noted was $20.26 on a farm in St. Charles County, Mo., rented for a 2/5 share. The highest average value of owned wheat land was $241 in Saline County, Mo.

The Trend of Costs and Wheat Prices.

The 1919 crop was produced at a high level of cost. All the items of cost had been increasing for several years (Fig. 40). The price of wheat also had risen at the same time and in somewhat greater proportion. The 1920 crop was grown at costs even higher than for the 1919 crop, but, before the 1920 crop could be disposed of, the price of wheat fell sharply, greatly reducing the returns.

For the 1921 crop, wages were somewhat lower, because, with the falling price of farm products, farmers were unwilling to pay the wages of the preceding five years. The prices of things farmers buy slacked off a little, but much less than the price of wheat. Land values, which had increased constantly, did not fall off much, and freight rates remained very high. The prospect for the 1922 crop is not particularly promising with respect to price. It is particularly necessary at this time for wheat farmers to grow the crop with small cash outlay, so that they may get for their own work all there is in the crop.

Method of Estimating Cost of Production Illustrated.

Each farmer, in his own interest, should forecast his costs and returns, and plan accordingly. Then he should observe as he works how closely he can come to his plan; or

finding changes of operation advisable or forced on him, he will know at once how and how much the final results will be affected. At the end of the season he has a record of fact to compare with his forecast. Nobody can tell him more about the facts for his farm than he can have immediately available at any time with the very small amount of additional effort required to make definite observations, and preserve them in writing for reference and for use in making estimates and checking results. Farmers will find that careful estimating from *definite facts* of *their own*, in addition to whatever help they may get from statistics generally available, is of practical service in forming decisions leading to greater returns.

For convenience of those not in the habit of figuring costs, the following form is offered, using the figures for

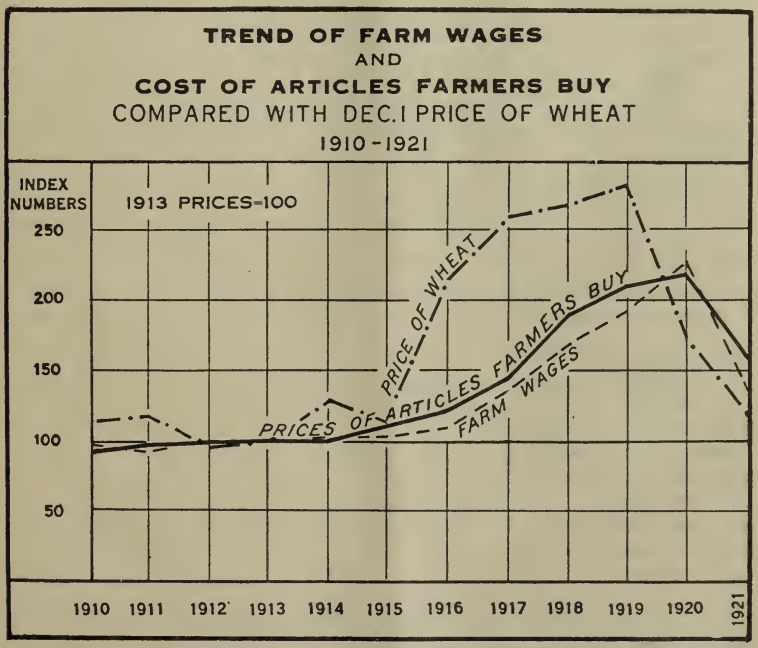


FIG. 40.—The course of prices and wages in the period 1910 to 1921 is shown in relative terms, using the prices and wages of 1913 as 100. Prices of articles farmers buy rose less rapidly than the price of wheat, but when the price of wheat fell sharply and greatly in 1920, farm wages and the prices of things farmers buy remained high, and have not yet fallen in line with the price of wheat.

the average farm in McPherson County, Kans., in 1919. Each farmer, of course, must use the cost rates he has determined for his own farm.

Examples for figuring costs per acre and per bushel.

Item of cost.	Average crop of 1919, McPherson County, Kans.			Your farm, 1921.			Your farm, 1922.		
	Amount.	Price.	Cost.	Amount.	Price.	Cost.	Amount.	Price.	Cost.
Acres of wheat per farm	133 a								
Production per farm	1,687 bu.								
Yield of wheat per acre	12.7 bu.								
Operating costs per acre:									
Preparation and seeding—									
Man labor	4.5 hrs.	$0.36	$1.62						
Horse labor	18.8 hrs.	.19	3.58						
Harvesting and marketing—									
Man labor	4.8 hrs.	.80	3.89						
Horse labor	8.1 hrs.	.20	1.61						
Seed	1.19 bu.	1.98	2.36						
Binder twine	2.8 lbs.	.23	.63						
Thrashing (¾ shock thrashed)	12.7 bu.	.23	2.83						
Total of above cost items (76 per cent of total operating cost)[1]			16.52						
Other operating costs (24 per cent)			5.24						
Total operating cost per acre			21.76						
Operating cost per bushel ($21.76÷yield 12.7 bushels)			1.71						
Rent, or current interest on fair valuation of land			8.44						
Cost per acre, including land			30.20						
Cost per bushel, including land ($30.20÷12.7)			2.38						

[1] These costs may not hold exactly at 76 per cent for individual farms showing wide variations in the size of the sum of items listed nor for those with unusually high or low other miscellaneous costs.

Financing Wheat Production.

To a very considerable extent, indeed to a far greater degree than in most other industries, the financing of the wheat crop is done with the farmers' own capital. The credit

sought and obtained in most cases is only supplementary to the capital invested by the farmer himself. The wheat grower may need production credit, which will enable him to prepare his soil, procure suitable seed, maintain his family and live stock during the crop-growing season, and to employ help in reaping and thrashing his grain. All of this credit will not be needed, of course, for the entire production period, but must be available for use when needed in carrying out the farm program. Its term, therefore, may vary from a few days to six months, and it is needed longer in case prices at thrashing time are so low that holding the wheat seems desirable.

An inquiry from banks, conducted by the department some months ago, indicated that in Kansas, a typical winter-wheat State, 45 per cent of the loans to farmers were made on their personal notes, without indorsement; 13 per cent on notes with one or more indorsements; 29 per cent on live-stock mortgages; 10 per cent on crop liens; and the remaining 3 per cent on warehouse receipts, stocks and bonds, and miscellaneous security. In North Dakota, a typical spring-wheat State, the same inquiry indicated that 27 per cent of the farmers' loans were obtained on notes without indorsement, 9 per cent on notes with indorsement, 43 per cent on live-stock mortgages, 12 per cent on crop liens, and the remaining 9 per cent on warehouse receipts, stocks and bonds, and other forms of security.

Doubtless the crop to be produced should constitute the leading security for a loan obtained to assist in its production, as in effect the money is invested in the crop. Owing to the hazards to which growing crops are exposed, however, crop liens are not looked upon as a desirable form of security. The thing needed to bring crops into use as security for loans is a suitable form of crop insurance. Hitherto, hail insurance has been the only form of such insurance generally available. This by no means fully meets the requirements. Crop insurance, like life insurance, should cover all hazards beyond the control of the insured. Several attempts already have been made to give such coverage, and it is to be hoped that general crop insurance will in some way be made available on reasonable terms.

Marketing Wheat.

When a farmer hauls a load of wheat to a flour mill and exchanges it for flour and feed the problem of marketing is a very simple one. Usually, however, the processes of marketing are much more complex than this. The wheat is hauled to a country elevator and sold. The price paid for it, and, to some extent, the marketing processes which follow, are determined by many factors, some of them far beyond the control of the farmer. Among these factors are (1) the class of wheat grown, (2) the quality of the grain sold, (3) the direction, distance, time, and rate of movement of wheat, (4) the farmer's financial situation, (5) the freight rate charged, and (6) the total production at home and abroad and the quantity carried over from previous crops. Discussion of these factors follows.

Classes of Wheat.

Under the Official Wheat Standards of the United States, wheat is separated into six commercial classes as follows: (1) Hard Red Spring, (2) Durum, (3) Hard Red Winter, (4) Soft Red Winter, (5) Common White, and (6) White Club.[1] If wheat of one class has more than 10 per cent of another mixed with it, the mixture is classed "Mixed Wheat." Four classes, Hard Red Spring, Durum, Hard Red Winter, and Common White, are divided into subclasses on the basis of color and texture of kernels. Each of the first three classes named has three subclasses, while Common White has two subclasses. Subclasses are recognized because, so far as these classes are concerned, the best outward index of quality, from the standpoint of utilization of flour made therefrom, is the color and texture of the kernels, that is, whether dark, hard and vitreous, or yellow, mottled, and starchy.

Hard Red Spring wheat is grown principally in the north-central part of the United States (Fig. 41), where the winters are too severe for the production of winter wheat. Nearly 14 million acres of this class of wheat are grown annually in the United States, comprising nearly one-fourth of the

[1] Classes 5 and 6 have been combined by recent order of the Secretary of Agriculture, effective July 17, 1922.

total wheat acreage. Although there are 24 varieties of Hard Red Spring wheat, about two-thirds of the acreage of this class is sown to one variety, Marquis. The strongest flours for bread making are produced from Hard Red Spring wheat.

Durum wheat is grown in almost the same area (Fig. 42) as Hard Red Spring wheat. The district of heaviest production of durum wheat is just west of the Red River Valley in North Dakota. About 4 million acres of durum wheat have been grown annually in the United States for several years. It comprises about one-sixteenth of the total wheat acreage. Arnautka and Kubanka are the leading varieties among the 11 commercial durum wheats grown.

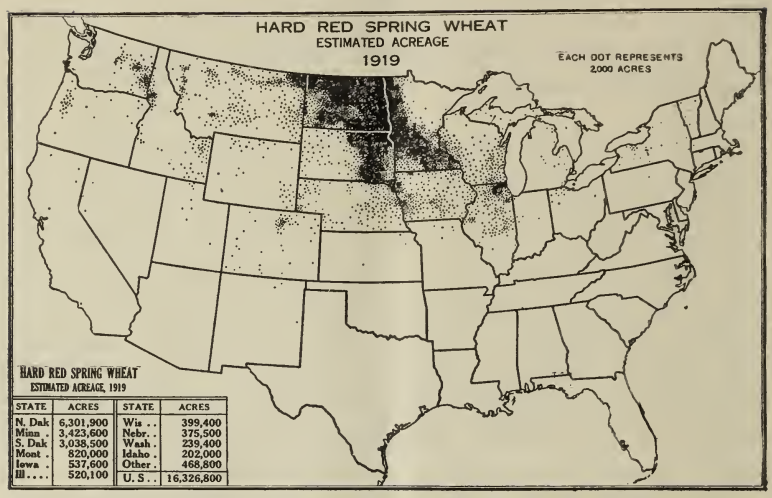
Durum wheat usually yields more than Hard Red Spring wheat in this northern spring-wheat belt, because of its greater resistance to drought and to black stem rust.

Hard Red Winter wheat is grown principally in the central Great Plains area (Fig. 43), where dry summers and rather dry winters prevail. Hard Red Winter wheat is not well adapted to humid sections. More than 17 million acres are grown annually in the United States, comprising nearly one-third of the total wheat acreage. The leading varieties are Turkey, Kharkof, and Kanred. Hard Red Winter wheat is used in the manufacture of bread-making flour.

Soft Red Winter wheat is grown largely in the humid sections in the eastern half of the United States (Fig. 44). About 16 million acres are grown annually, comprising over 30 per cent of the total wheat acreage. About 65 varieties are grown, the principal ones being Fultz, Fulcaster, Mediterranean, Poole, Red May, and Red Wave.

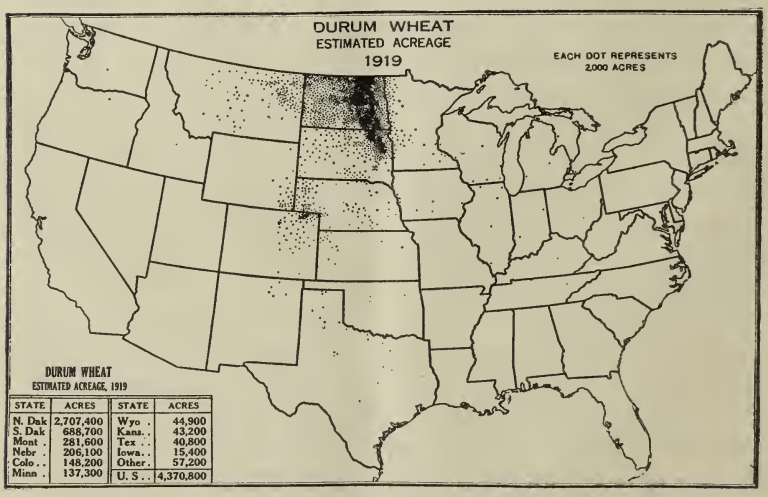
Soft Red Winter wheat is used in the manufacture of both bread-making and pastry flours. The flour from Hard Red Spring and Hard Red Winter wheats often is blended with that of this class to make it a stronger bread flour.

Common White wheat is grown in both the eastern and western parts of the United States (Fig. 45). Where now grown it usually outyields the other classes of wheat. Over 3 million acres, or somewhat more than 5 per cent of the total wheat acreage, is sown to Common White wheat annually in the United States. More than 50 varieties are grown, the leading ones being Pacific Bluestem, Goldcoin, Baart, Defi-



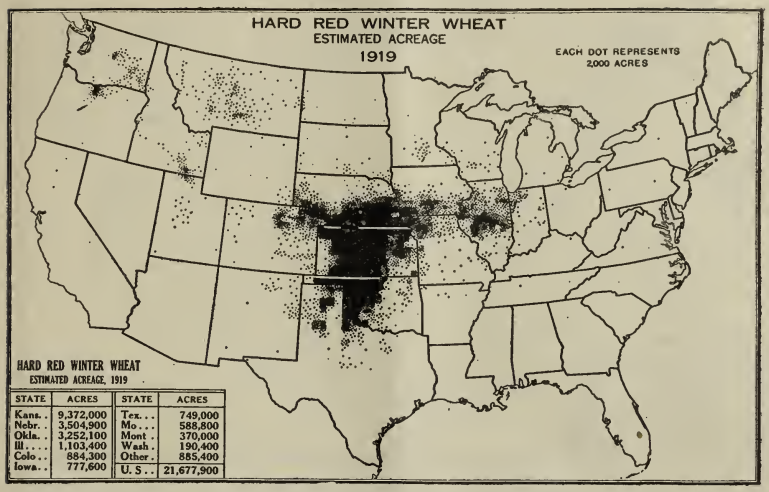
STATE	ACRES	STATE	ACRES
N. Dak	6,301,900	Wis . .	399,400
Minn .	3,423,600	Nebr. .	375,500
S. Dak	3,038,500	Wash .	239,400
Mont .	820,000	Idaho .	202,000
Iowa .	537,600	Other .	468,800
Ill. . . .	520,100	U. S. .	16,326,800

FIG. 41.—More than two-thirds of the spring wheat of the United States belongs to this class, which is grown under subhumid to semiarid conditions favorable to high quality. North Dakota, Minnesota, and South Dakota lead in its production. It sets the standard for bread-making flour.



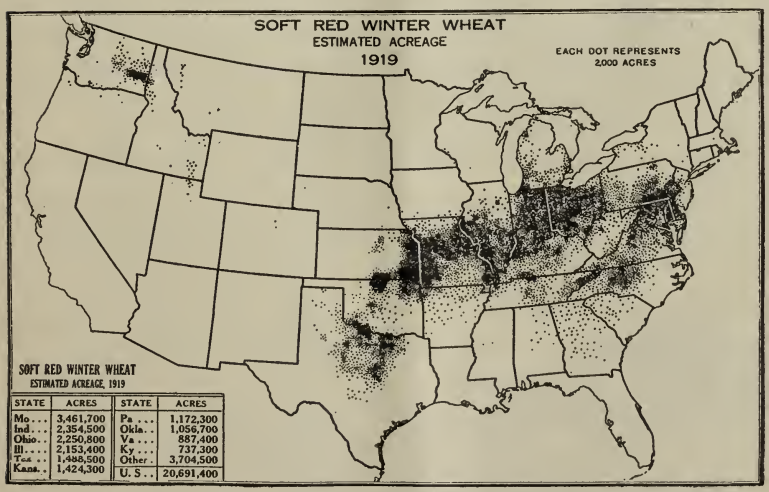
STATE	ACRES	STATE	ACRES
N. Dak	2,707,400	Wyo . .	44,900
S. Dak	688,700	Kans. .	43,200
Mont .	281,600	Tex . .	40,800
Nebr .	206,100	Iowa . .	15,400
Colo . .	148,200	Other.	57,200
Minn .	137,300	U. S. .	4,370,800

FIG. 42.—Durum wheat is grown in the midst of the hard red spring wheat area. The center of the area of production gradually is moving westward to drier districts. From durum wheat is made a granular flour called semolina from which macaroni, spaghetti, vermicelli, and other edible pastes are manufactured.



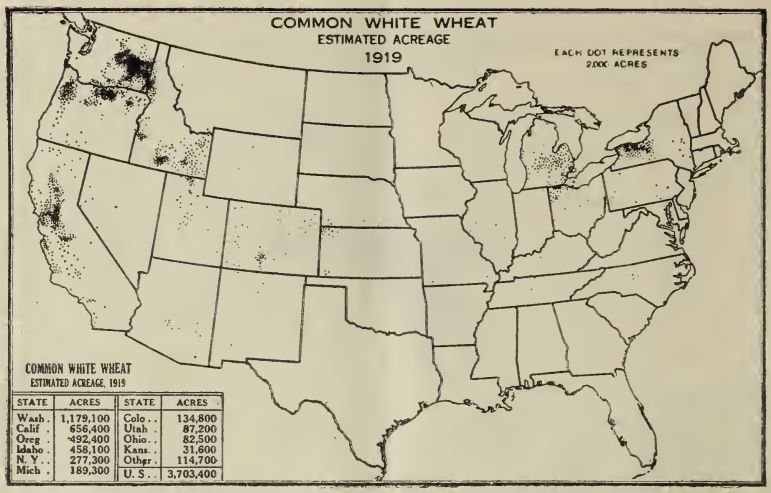
STATE	ACRES	STATE	ACRES
Kans.	9,372,000	Tex.	749,000
Nebr.	3,504,900	Mo.	588,800
Okla.	3,252,100	Mont.	370,000
Ill.	1,103,400	Wash.	190,400
Colo.	884,300	Other	885,400
Iowa.	777,600	U. S.	21,677,900

FIG. 43.—Hard red winter wheat is produced in enormous quantities in the central section of the Great Plains area. It occupies nearly one-third of the total acreage of all wheat and about half of the total winter-wheat acreage in the United States. Wheat of this class ranks next to hard red spring in quality for flour manufacture.



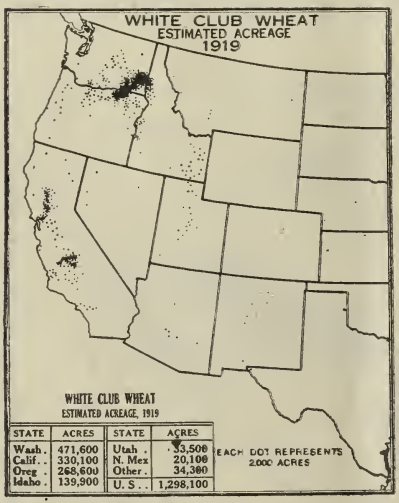
STATE	ACRES	STATE	ACRES
Mo.	3,461,700	Pa.	1,172,300
Ind.	2,354,500	Okla.	1,056,700
Ohio.	2,250,800	Va.	887,400
Ill.	2,153,400	Ky.	737,300
Tex.	1,488,500	Other	3,704,500
Kans.	1,424,300	U. S.	20,691,400

FIG. 44.—Soft red winter wheat is grown over a wide area, mostly under humid conditions. It also occupies nearly one-third of the total acreage of all wheat and nearly one-half of the total acreage of winter wheat. The States leading in its production are Missouri, Indiana, Ohio, and Illinois.



STATE	ACRES	STATE	ACRES
Wash.	1,179,100	Colo.	134,800
Calif.	656,400	Utah	87,200
Oreg.	492,400	Ohio	82,500
Idaho	458,100	Kans.	31,600
N. Y.	277,300	Other	114,700
Mich.	189,300	U. S.	3,703,400

FIG. 45.—Common white wheat is grown chiefly in the Far West but also in the Great Lakes section. Washington, California, Oregon, and Idaho lead in its production in the West; New York and Michigan in the East.



STATE	ACRES	STATE	ACRES
Wash.	471,600	Utah	33,500
Calif.	330,100	N. Mex	20,100
Oreg.	268,600	Other	34,300
Idaho	139,900	U. S.	1,298,100

FIG. 46.—White Club wheat is grown only in the West, chiefly in Washington, Oregon, California, and Idaho.

ance, Dicklow, and Dawson (Golden Chaff). Common White wheat is used in making pastry flours and breakfast foods and to some extent in bread-making flours.

White Club wheat is grown only in the western part of this country (Fig. 46). In some sections in this region it outyields all other classes. Although more than 1 million acres of White Club wheat are grown annually, it comprises less than 2 per cent of the total wheat acreage. White Club wheat is used in making starchy flours for pastry or is exported to South America and the Orient.

Quality of the Wheat Crops.

The wheat crop varies in quality from year to year, as a result of climatic and other conditions during the growing season, and especially in the harvest period. Each year the Department of Agriculture estimates the average quality of the crop from reports received from many farmers, millers, and elevator operators. These estimates for the 22 years, 1900 to 1921, are given in Figure 47. They may be considered as a general index for each year of all the conditions that have affected the crop while it was on the farm

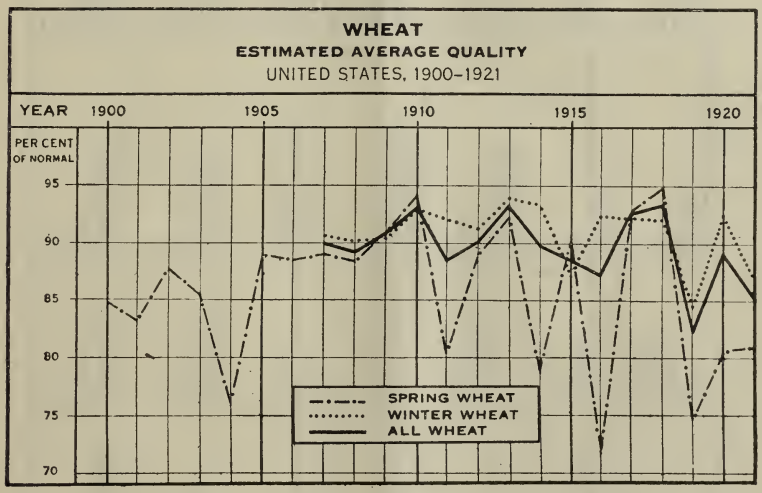


FIG. 47.—The quality of the wheat crop varies with the conditions under which it was grown. Unfavorable weather during growth, harvest, or thrashing is reflected in the quality of the grain. Drought, rain, and rust are the chief factors.

and, as such, they enable a comparison to be made of the general seasonal conditions as well as the crops of different years.

The very low quality of spring wheat in 1904 and 1916 was due chiefly to epidemics of stem rust. The low quality of spring wheat in 1911 and 1914 was due chiefly to severe drought. The low quality of all wheat in 1919 was due partly to drought, partly to rust, and partly to excessive summer rains. The crop of 1921 was of rather low quality, winter wheat being 87.1 per cent, spring wheat 82.2 per cent, and the average of all wheat 85.8 per cent, owing to summer heat and other causes.

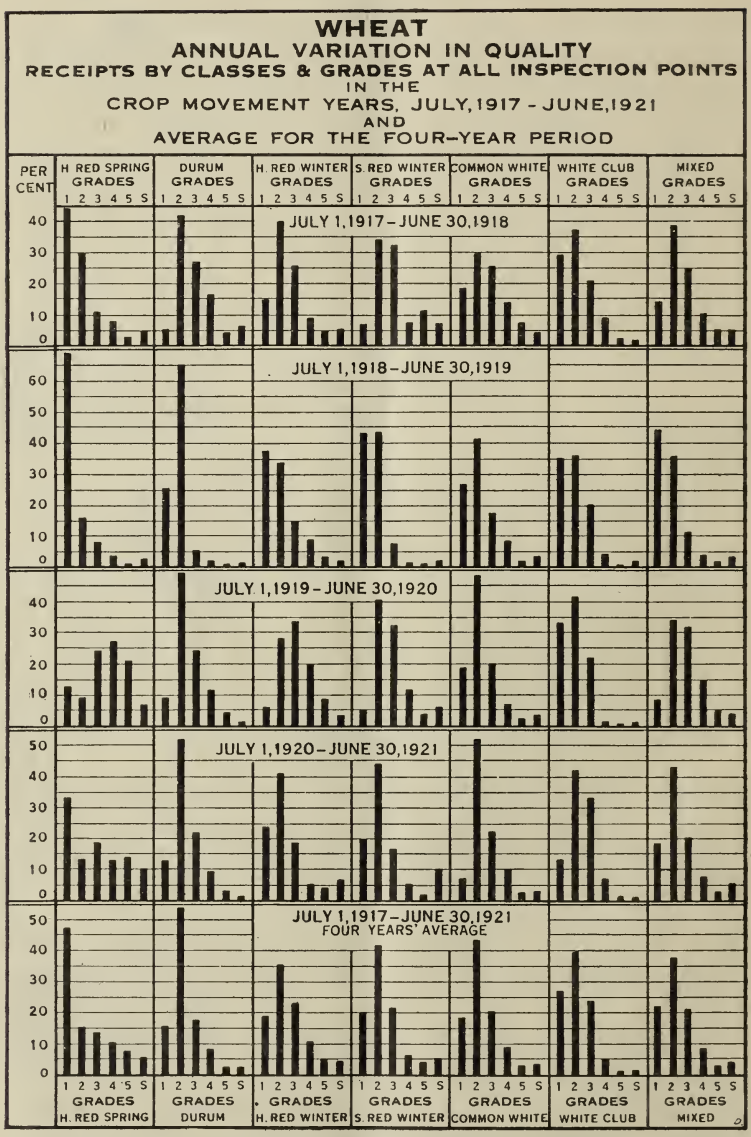


FIG. 48.—In these 4 years the great bulk of the wheat falls into the three upper grades, Nos. 1, 2, and 3. Nearly half of the hard red spring wheat, on the average, goes into No. 1. On the average of good and bad crop years together, more than 50 per cent of all wheat inspected is graded No. 1 and No. 2.

Quality as Shown by Grade.

The quality and consequent grade of wheat are dependent primarily upon the weather conditions which prevail during the growing season and harvest and the conditions under which wheat is stored from time of harvest until it is marketed.

Each subclass of wheat is divided into five numerical grades (1, 2, 3, 4, and 5), dependent upon the following factors: Test weight per bushel, moisture content, percentage of damaged kernels, purity, cleanliness, and condition. Wheat failing to meet the specifications for any one of the five numerical grades is graded "Sample Grade."

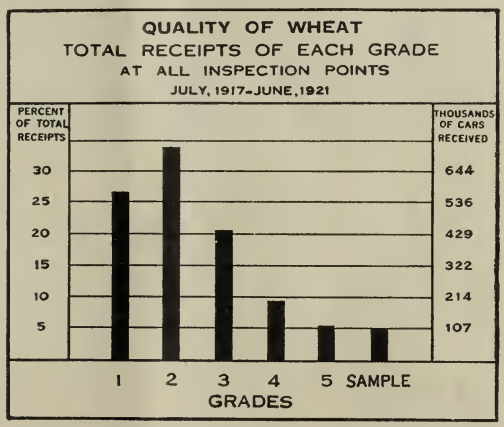


FIG. 49.—Bird's-eye view of wheat quality. Inspected receipts of all six classes, in all four years. About 60 per cent in grades 1 and 2, and about 80 per cent in grades 1, 2, and 3.

Wheat, after leaving the farm, in finding its way through channels of interstate commerce to distant mills and to seaboard cities for export, is inspected and graded at terminal markets in accordance with the official wheat standards of the United States. There were 92 such inspection points in 1917, 118 in 1918, 143 in 1919, 158 in 1920, and 167 in 1921. The inspectors at terminal markets are not employees of the Government, but are employed by State grain-inspection departments, chambers of commerce, and boards of trade, or in some cases they operate independently on a fee basis. These inspectors, however, are licensed by the United States Department of Agriculture, and use the Federal standards.

In Figure 48 is shown the annual and average quality of the wheat produced in the United States in the four years, 1917 to 1920, inclusive, as indicated by the grades given to that portion of the crop which moved in interstate commerce from July, 1917, to June, 1921, inclusive. The graph is

based upon the total carload receipts inspected at all inspection points in each year. Figure 49 shows in the same way the average quality of all classes in all four years. An indication of the effect of class and quality (grade) of wheat on price is given in Figure 59.

Surplus and Deficiency of Production in Relation to Movement of the Wheat Crop.

The marketing of wheat takes from the farm producer what he does not keep for food, feed, and seed, and places it in the hands of other consumers. It is estimated that

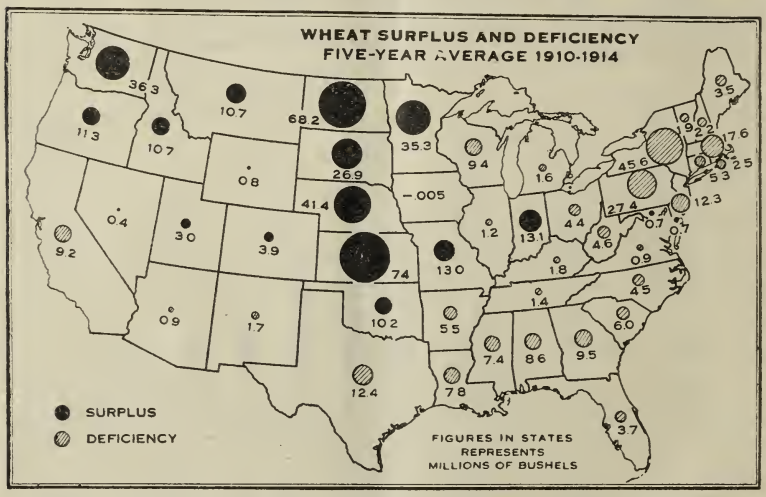


FIG. 50.—The States east of the Mississippi, except Indiana, Maryland, and Delaware, do not produce enough to supply their own needs, and the same is true of the Southwest from Texas to California. The great surplus-producing States are Kansas, North Dakota, Nebraska, Minnesota, and Washington.

about 60 per cent of the wheat crop ordinarily is shipped out of the county where grown. This may be considered the commercial crop, and it is this part with which we must deal in the discussion of wheat marketing.

A large part of the farm surplus is consumed in the United States by farmers who do not produce enough for their own needs and by people who are not engaged in agriculture.

Under the average conditions of the five years, 1910–1914, inclusive, 19 States (Fig. 50) each had a surplus of wheat above its own requirements for food, feed, and seed. This surplus supplied the other 30 States whose wheat production severally was below their consumption and provided the national surplus for export.

FIG. 51.—A busy day at a country elevator.

Movement from the Farm.

The first movement of wheat from the farmer to the ultimate consumer usually is to the local or country elevator (Fig. 51) and thence to great terminal elevators (Fig. 52) for further distribution to mills at home and abroad.

FIG. 52.—Terminal elevator surrounded by cars loaded with grain.

The wheat may be hauled directly from the separator as it is thrashed, or it may be binned on the farm first, or part may be handled in each way. In general, however, a rapid movement begins soon after harvest (Fig. 53), due to the necessity for money, the lack of storage space, and the cost of storing. In the Far West sack handling still is the rule, and, though much grain moves direct from separator or "combine" to the warehouse, the dry summer climate allows cheap storage on the farm, where the bags may lie for weeks in a great rick in the field without cover.

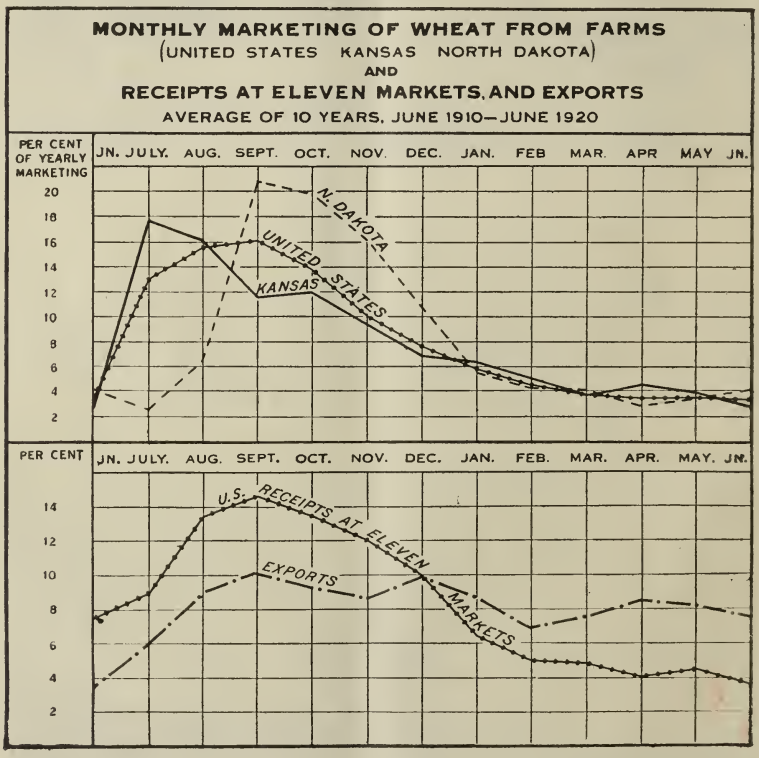


FIG. 53.—Movement of wheat from the farms is very rapid after harvest, which is progressively later from south to north. Nearly three-fourths of the crop leaves the farms in the first six months of the crop-movement year. Receipts at central markets naturally correspond very closely; exports, on the other hand, are much more evenly distributed throughout the year. (See Fig. 59 also.)

The average time and the rate of movement from the farm in Kansas and North Dakota and in the whole United States are shown in Figure 53. From Kansas the movement begins in the latter part of June or in early July. The heaviest movement from the farms in Kansas ordinarily is in July. As one goes farther north the harvest and the beginning of movement occur successively later. In North Dakota the new crop does not begin to move until in August and the peak of the flow occurs in September.

For the whole country, the peak of flow from farms is in August and September, with gradual decrease to January. More than one-third of the crop was marketed in July and August in the 10-year period (1911–1920) and nearly three-fourths of the entire crop in the first six months of the crop-movement year, namely, from July to December, inclusive.

The lower part of Figure 53 shows the progressive monthly receipts at 11 principal markets in the North Central States, and the exports from the country. Market receipts are seen to agree well with the movement from farms, but exports are much more evenly distributed throughout the year.

Financing Wheat Storage and Movement.

Since the fall in prices of farm products in 1920, marketing credit has called for increased attention. By marketing credit, in so far as the farmer is concerned, is meant chiefly the credit which is needed after the grain has been harvested and which will enable him to market his grain in an orderly manner. The amount and duration of this credit depends largely, as already intimated, upon the condition of the market. If the price of wheat is high, the farmer is inclined to sell quickly, in which case credit obligations at the banks will be rapidly reduced. Rapid release of a large volume of the crop, however, may have the effect of congesting transportation and storage facilities and depressing the price (Fig. 59). When market prices are exceptionally low, there is a natural tendency to postpone selling, and this causes a special demand for credit. In the absence of a suitable warehouse system, the security for such loans frequently is the same as for production credit. In many cases existing obligations are renewed for increased amounts.

The development of a well-organized warehouse system would be highly advantageous to wheat growers, as well as to producers of other nonperishable agricultural products, in obtaining credit during the marketing season. By utilizing a licensed and properly supervised warehouse, the farmer should find little difficulty in obtaining advances on his note secured by a warehouse receipt, or on drafts accepted by a warehouse association, when he desires to defer the selling of his crop. Such notes would be eligible for rediscount for six months at the various Federal reserve banks, when the proceeds are used for agricultural purposes.

Only meager information is available on the financing involved in the orderly movement of the wheat crop from the farmer to the mill or the exporter. Some interesting data on the sources of borrowings by different types of country elevators and warehouses, however, have been compiled by the Federal Trade Commission. The study covered a total of 4,925 establishments, including 2,353 line houses and 2,572 individual houses. The so-called line houses were subdivided as commercial, cooperative, mill, and malster, while the individual establishments were classified as cooperative, independent, mill, and malster.

All line houses, it was found, were financed largely by the head offices, this source of funds representing over 80 per cent of the total borrowings. Local banks furnished about 11 per cent of the loans, and the balance came from commission houses, mills, city banks, and other sources.

The individual houses were financed more largely by local banks, which furnished, in their case, 65 per cent of the total borrowings. Commission houses furnished 17 per cent and mills 3 per cent, while farmers and other local residents furnished about 2½ per cent. The balance, as in the case of line elevators, came from scattered sources.

There is little doubt, of course, that the commission houses, as well as the head offices of line elevators, in turn rely upon the larger city banks for considerable amounts of credit.

Freight Rates.

The expense or cost of taking wheat from the farm to the market is an important factor in determining the price the farmer obtains for it. Freight rates make up an important part of the costs of marketing. Before the war it cost from 8 to 10 cents per bushel to ship wheat from Chicago to New York (Fig. 54) and about 12 cents from Kansas City to New Orleans. Beginning with 1917 the rates rose, and by 1920 they had doubled. The history of freight rates from Chi-

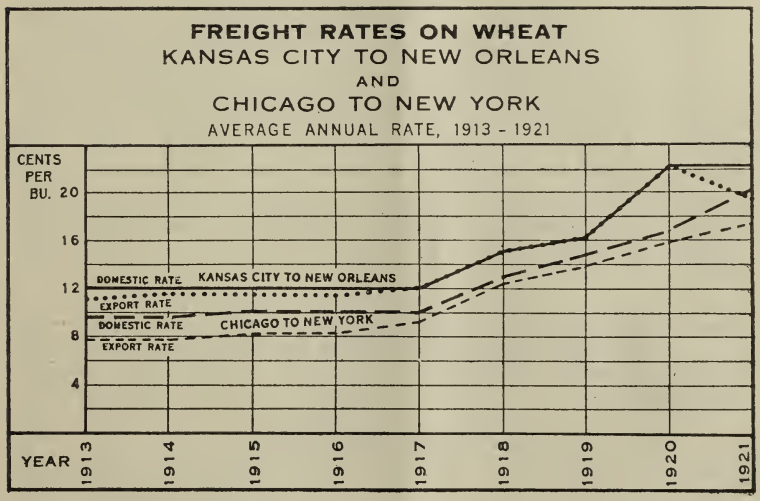


FIG. 54.—Freight rates on wheat from Chicago to New York and Kansas City to New Orleans rose rapidly with our entry into the World War and were higher in 1920 and 1921 than at any time since 1886. The average ocean rate for 1921 was higher than that of any prewar year for which records are available.

cago to New York is interesting. Following the Civil War rates were very high. Later they declined from about 32 cents per bushel in 1870–1873 to 8 cents per bushel in 1905.

The rate for 1920 was the highest since 1886. The high rates scarcely were felt until the price of wheat started downward. To pay 16 cents out of $2.70 did not seem as burdensome as paying 8 cents out of $1, but when the price of wheat fell to $1.60 in New York, as it did in 1921, the 16-cent rate became a real burden, as most of the surplus wheat is produced west of Chicago.

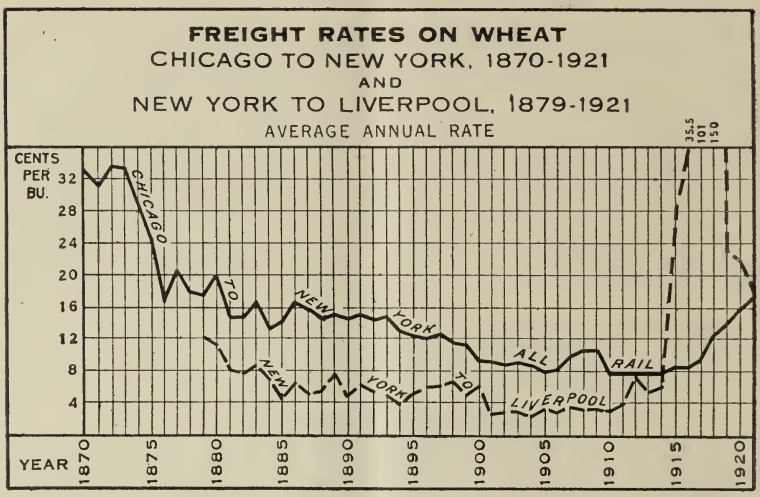


FIG. 55.—The freight rate from Chicago to New York is the export rate. The domestic rate is higher than the export rate, if there is any difference between the two. The New York to Liverpool rate rose above $1.50 in 1918. (See Fig. 56.)

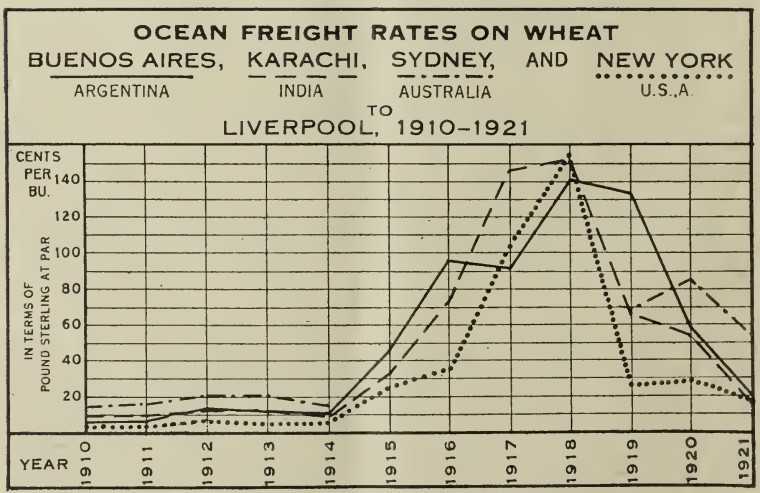


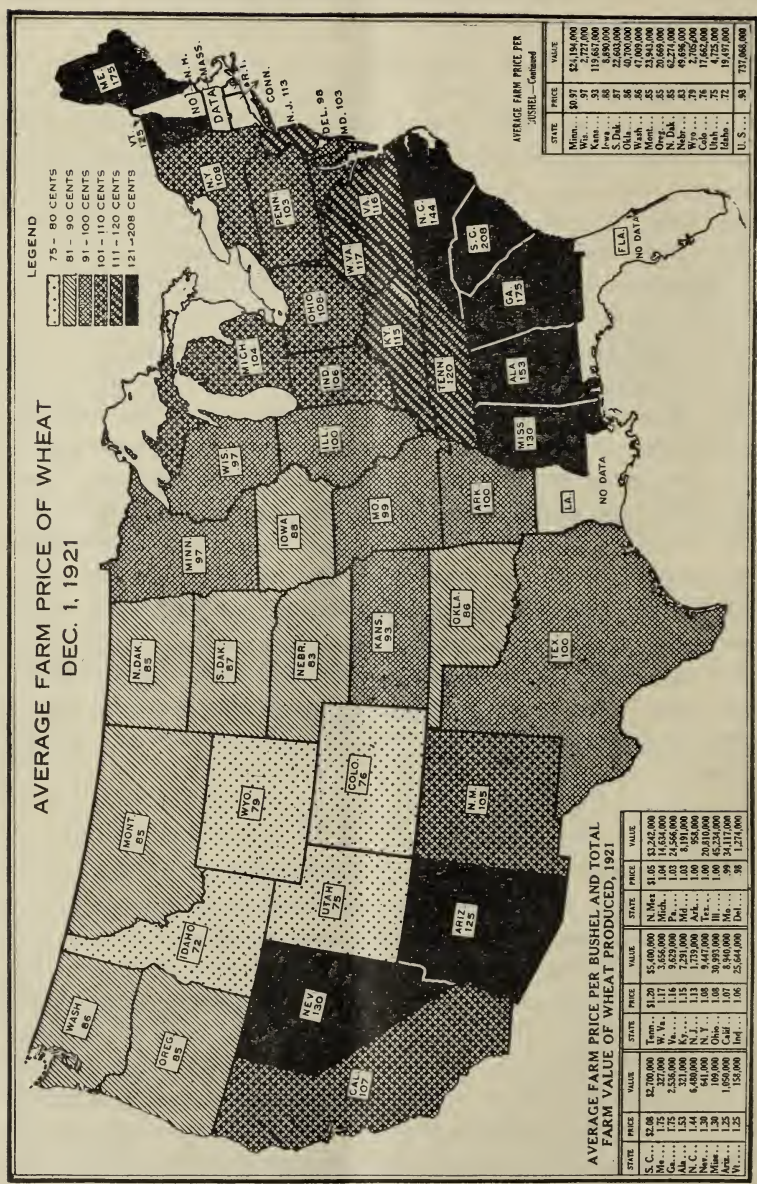
FIG. 56.—Ocean freight rates rose rapidly after the outbreak of the World War in 1914 and fell rapidly after the signing of the armistice on November 11, 1918, while rail freight rates (see Fig. 54) rose with our entry into the war and have not fallen. The New York to Liverpool rate usually is lower than from points in other producing countries because of the shorter distance.

The ocean rates on wheat from New York to Liverpool (Fig. 55) had declined to a very low point before the World War. In the 10-year period, 1901–1910, it cost less than 4 cents a bushel to ship wheat from New York to Liverpool. The submarine warfare made shipping very scarce and ocean freighting a very hazardous enterprise. Rates became very high; in fact, the allied Governments practically fixed rates through the most critical period of the war. Soon after peace was declared, rates began to fall, but they have not yet returned to the prewar level. The quotation for January 27, 1922, was 9¼ cents per bushel, or more than double the quotation for January 30, 1914, which was 4½ cents.

The rates from New York to Liverpool, England, a great import market for Europe, generally are less than the rates from other wheat-exporting countries (Fig. 56). The longest haul is from Sydney to Liverpool, and from this point naturally the rates are highest. The rates from all countries were very high during the World War, but declined immediately after the Armistice. Rates from New York have fallen more rapidly than the rates from any other point, presumably because there is more competition for shipping from New York to Liverpool than from other points. It may be noted also that during the first part of the war period rates from New York to Liverpool were much cheaper than rates from other countries, which explains in part the very great increase in our exports.

Prices of Wheat.

Many factors enter into the determination of the price paid for wheat to producers in any locality at a given time. Among the important factors to be considered are (1) character of the local market, whether it is in an area of surplus or deficiency production (Fig. 50); (2) the distance to markets and cost of transportation (Fig. 57); (3) the time in relation to the season (Fig. 59); (4) the total available supply for the markets of the world in relation to the consumers' demands; and (5) financial conditions and prices of other commodities. Prices paid at the principal central and export markets are determined by similar conditions. The several factors to be considered can be discussed only briefly here.



STATE	PRICE	VALUE	STATE	PRICE	VALUE	STATE	PRICE	VALUE
S. C.	$2.08	$2,700,000	Tenn.	$1.20	$5,400,000	N. Mex.	$1.05	$3,242,000
Me.	1.75	327,000	W. Va.	1.17	3,656,000	Mich.	1.04	14,634,000
Ga.	1.75	2,555,000	Va.	1.16	9,020,000	Ind.	1.03	24,580,000
Ala.	1.53	321,000	Ky.	1.15	7,231,000	Pa.	1.03	4,500,000
N. C.	1.44	6,480,000	N. J.	1.13	1,739,000	Ark.	1.00	955,000
Nev.	1.30	641,000	N. Y.	1.08	9,447,000	Tex.	1.00	20,010,000
Mass.	1.30	1,300,000	Ohio	1.08	30,393,000	Ill.	1.00	45,234,000
Ariz.	1.25	1,894,000	Calif.	1.08	8,100,000	Mo.	1.00	34,111,000
Wy.	1.25	158,000	Ind.	1.06	25,644,000	Del.	.98	1,271,000

STATE	PRICE	VALUE
Minn.	$0.97	$25,194,000
Wis.	.97	2,727,000
Kans.	.93	119,667,000
Iowa	.88	8,890,000
S. Dak.	.87	2,610,000
Okla.	.87	42,700,000
Wash.	.86	47,000,000
Mont.	.85	23,943,000
Oreg.	.85	20,669,000
N. Dak.	.85	62,271,000
Nebr.	.83	49,896,000
Wyo.	.79	2,705,000
Colo.	.78	17,662,000
Utah	.75	1,425,000
Idaho	.72	19,175,000
U. S.	.93	737,966,000

FIG. 57.—The average farm price of wheat is lowest in the States producing surpluses (see Fig. 50) and farthest from large central markets. The price is highest in those States deficient in production and farthest from the central markets where they must buy. Intervening mountain ranges have the effect of increased distance.

Farm Prices.

Local variations in farm prices.—The wide variation in the prices paid wheat producers in the United States upon any given date is illustrated on the map in Figure 57, which shows the geographic distribution of wheat prices received by producers on December 1, 1921. Prices are lowest in those surplus-producing States which are most disadvantageously located with respect to the large world markets, and highest in those States of deficiency production which are most disadvantageously located with respect to supplies. Farmers in surplus-producing areas receive approximately the price paid at the nearest large central or terminal market, less the cost of placing their wheat upon that market. Farmers in deficiency areas receive approximately the price paid to producers in the most distant surplus-producing area from which the deficiency is made up, plus the cost of shipping that wheat into their locality.

Annual variations in farm prices.—Variations in the world's production and demand and changes in price levels cause nation-wide variations in the farm prices of wheat (Fig. 58.) Examples of the effects of large and small crops, wars, Government price fixing, and inflation and deflation all are shown in the movements of prices through the last 10 years.

In the first two years, 1912–1913, crops were good, and there were only the normal seasonal price movements, mostly between 75 cents and $1 per bushel. In 1914 the World War broke out, and the price rose rapidly through the remainder of the season until on May 1, 1915, it reached approximately $1.40. The high prices in the autumn and spring encouraged a greatly enlarged acreage, and an unusually good season caused high yields and the greatest production ever had in this country. Consequently by the 1st of June, when a large crop seemed certain, prices had begun to fall. All of the important surplus-producing countries except Australia produced large crops, and consequently prices remained low through the crop year 1915–16. In 1916 the Russian surplus was shut out of the world's markets, the crop of

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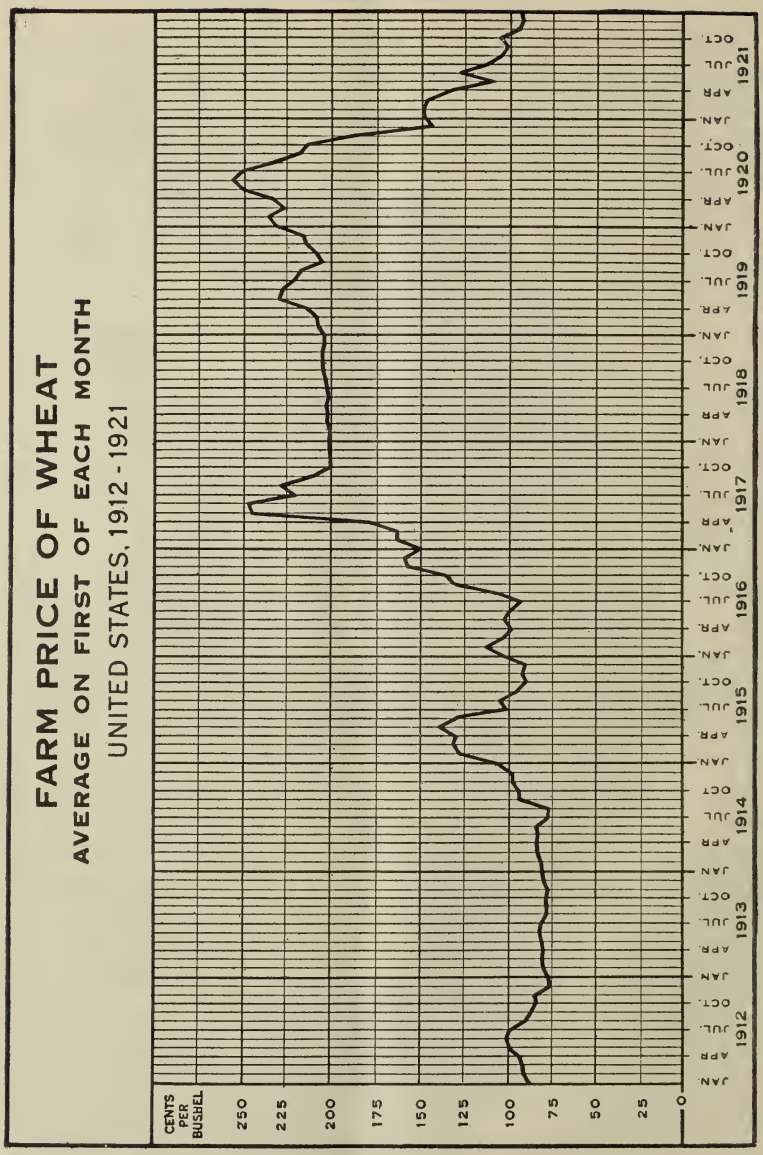

FIG. 58.—Note low farm price levels before the war, rise at the beginning of the war, fall with enormous production in 1915, rise with low production caused by rust injury in 1916, high levels after the United States entered the war, and rapid deflation after June 1, 1920.

the United States was short because of reduced acreage and severe injury by black stem rust, and prices rose rapidly after July.

After the United States entered the war in April, 1917, steps were taken to regulate the distribution and the price of wheat. The Food and Fuel Control Act of August 10, 1917, guaranteed a minimum price of $2 per bushel for the crop of 1918. On August 30, 1917, the President fixed a minimum price for the 1917 crop at $2.20 per bushel for No. 1 northern spring and its equivalents at Chicago, with differentials for grades and markets. Through the operations of the United States Grain Corporation this became the basic price for wheat. The average farm price of the whole country remained at a level of about $2 per bushel throughout 1918. By an Executive order on June 21, 1918, the price of wheat was raised to $2.26 a bushel for No. 1 northern spring and its equivalents at Chicago. In the spring of 1919 wheat prices rose sharply, reaching $2.31 on May 1, but declined, under pressure of large acreage and large production, to about $2.10 by October 1. With decreases in acreage and estimated production, prices rose rapidly thereafter, reaching $2.58 on June 1, 1920, a month before the Government guaranty of a minimum price was terminated. General deflation began soon after and continued to the end of 1921, when the price stood near 90 cents.

Although the prices of all commodities did not rise as rapidly through 1916–17 as did the prices of wheat, after the price of wheat was fixed the average prices of all commodities continued to rise until May, 1920. Thus the prices through the war were not really as high as they seemed. Excepting the period from August, 1914, to October, 1915, and the period from August, 1916, to August, 1917, the price of wheat was relatively not far above the average prices of other commodities, and with the sharp break in the prices of other commodities wheat also fell. The precipitous fall and the low prices of 1921 have not been due to overproduction so much as to the general deflation of all prices. Compared with the general price level in 1921, the farm price of wheat fell to the lowest point it has ever reached in the United States.

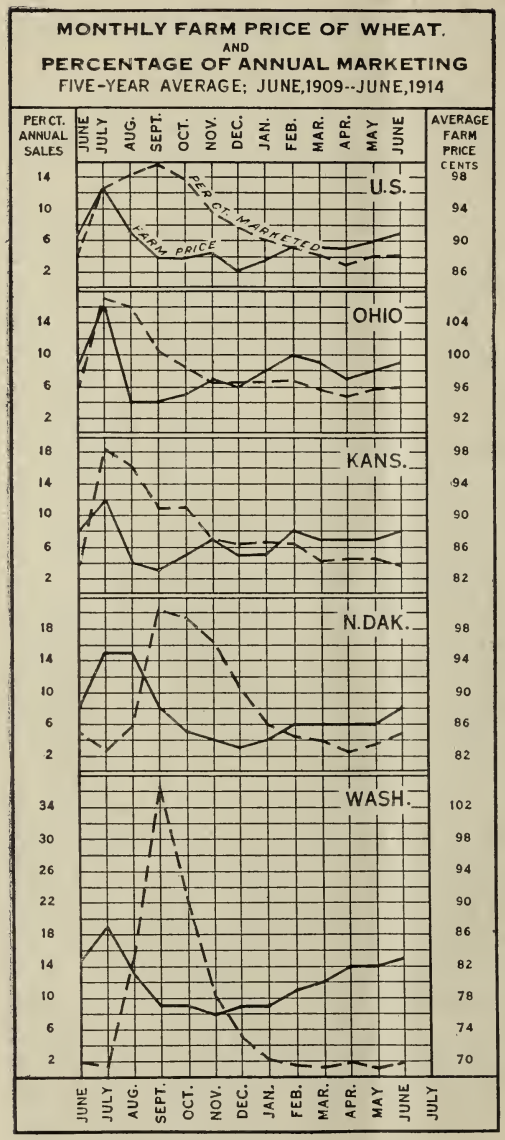

FIG. 59.—The farm price of wheat usually is relatively high on July 1, when the old crop is nearly gone and the new crop just beginning to move. Farm prices tend to fall rapidly during the next two months, when the great movement of wheat from the farms is taking place as harvest and thrashing progress.

Seasonal marketing in relation to farm prices.—A large part of the wheat crop is marketed in a few months after harvest (Fig. 59, see also Fig. 53), which causes a rapid decline in prices during the first few months of the new crop year (Figs. 58 and 59). This is one of the principal causes for the need of credit for storing grain. Taking the averages of farm prices of wheat by months from 1909 to 1913 as representing normal seasonal variations, it will be noted (Fig. 59) that the highest farm prices are paid about July 1, just as wheat of the new crop begins to arrive on the market. Prices decline rapidly from this high point until in September or October or occasionally later, after which they rise slowly and irregularly through winter, spring, and early summer to the highest point again about July 1.

Market Prices.

Market prices for wheat, like farm prices, vary with the class, subclass, and grade of wheat, as well as with the location and nature of the market.

Market prices of different grades of wheat.—In Figure 60 are shown the prices, by months, of No. 1 grade of the leading subclass of four classes of wheat, and the discounts in price for grades 2, 3, 4, and 5 below the price of No. 1. These figures cover the crop-movement year from July, 1920, to June, 1921, and cover subclasses at St. Louis, Kansas City, and Minneapolis. The prices are averages of the reported cash sales of each grade on those days in each month on which all five grades were represented. The prices of No. 1 are given in dollars and cents. The prices of the other grades are discounts in cents per bushel below the price of No. 1; for example, at St. Louis in July, 1920, No. 1 sold at $2.75; No. 2 at $2.73, a discount of 2 cents; and Nos. 4 and 5 at $2.70, a discount of 5 cents below No. 1.

An outstanding feature of the graph is the wide spread between the prices of the different grades of Dark Northern at Minneapolis, compared with the narrow spread between the prices of the different grades of Hard Winter at Kansas City. While the figures given cover only one year, a study of similar data for other years shows a fairly similar condition.

Probably several reasons must be sought for the difference in price spreads between the different grades in the different cases. Hard Red Spring wheat is used almost exclusively for domestic milling. Minneapolis is the largest milling center in the United States. Most of the wheat arriving there is bought by sample by mill buyers to whom low-grade wheat is not attractive. The best grade makes a flour of extra strength and quality and is in great demand for milling by itself and for blending with other wheats. For this reason premium prices are paid for grade No. 1. There is markedly less demand for the successively lower grades because they are of less value for blending with wheat of other classes. This will account, in considerable measure, for the very heavy discounts for the lower grades. Hard spring wheat

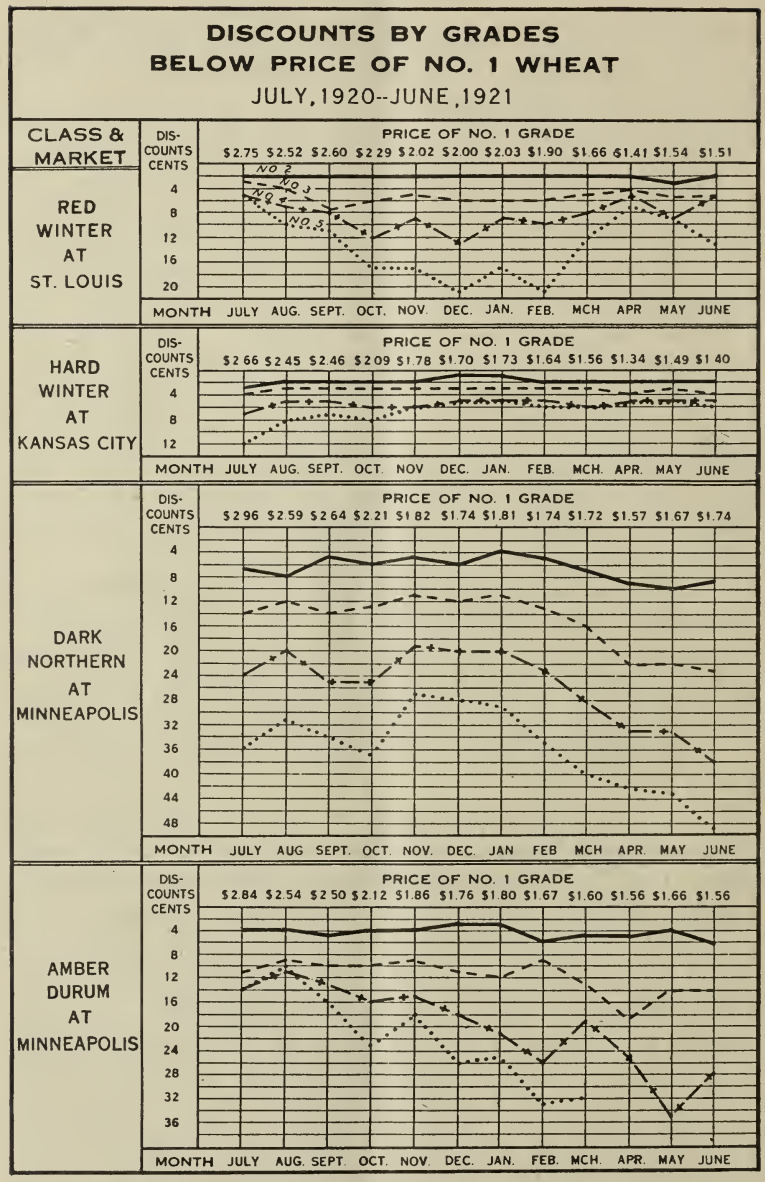

FIG. 60.—Market prices of No. 1 grade in the 1920 crop of the highest subclass in each of the four major classes of wheat, at one important market, by months, in the crop-movement year from July, 1920, to June 1921, with price discounts for grades 2, 3, 4, and 5 below the price of No. 1.

also usually is subject to more unfavorable climatic conditions than the winter wheats, and, therefore, more of it would fall into the lower grades, except that the requirements for admission to grade 1 are lower in the case of Hard Red Spring wheat. In spite of that fact about 35 per cent of the crop of 1920 graded below No. 3.

On the Kansas City market a considerable portion of the wheat is sold to exporters and to dealers other than millers whose competitive buying tends to absorb the lower grades at relatively small discounts. Grades 1 and 2 at Kansas City are both deliverable on contracts in the option or future trading market. Grade No. 3 also is deliverable upon future contracts at a discount of only 5 cents per bushel. These conditions serve to narrow the spread in price between grades, as compared with the spread in the milling market at Minneapolis.

Prices in world markets.—The prices of wheat in all the great markets of the world generally move together. The price in Liverpool generally is higher than the prices in New York and Chicago (Fig. 61), but it is very difficult to compare prices in these three markets. It is not proper to take the difference in prices as the cost of transporting and handling the wheat between the different markets. The cost of transportation and charges for handling are two different factors in causing the difference in prices. Market quotations in New York and Chicago generally follow very closely the market quotations in Liverpool, but certain conditions may so affect any one of the three markets as to throw it out of line with the others.

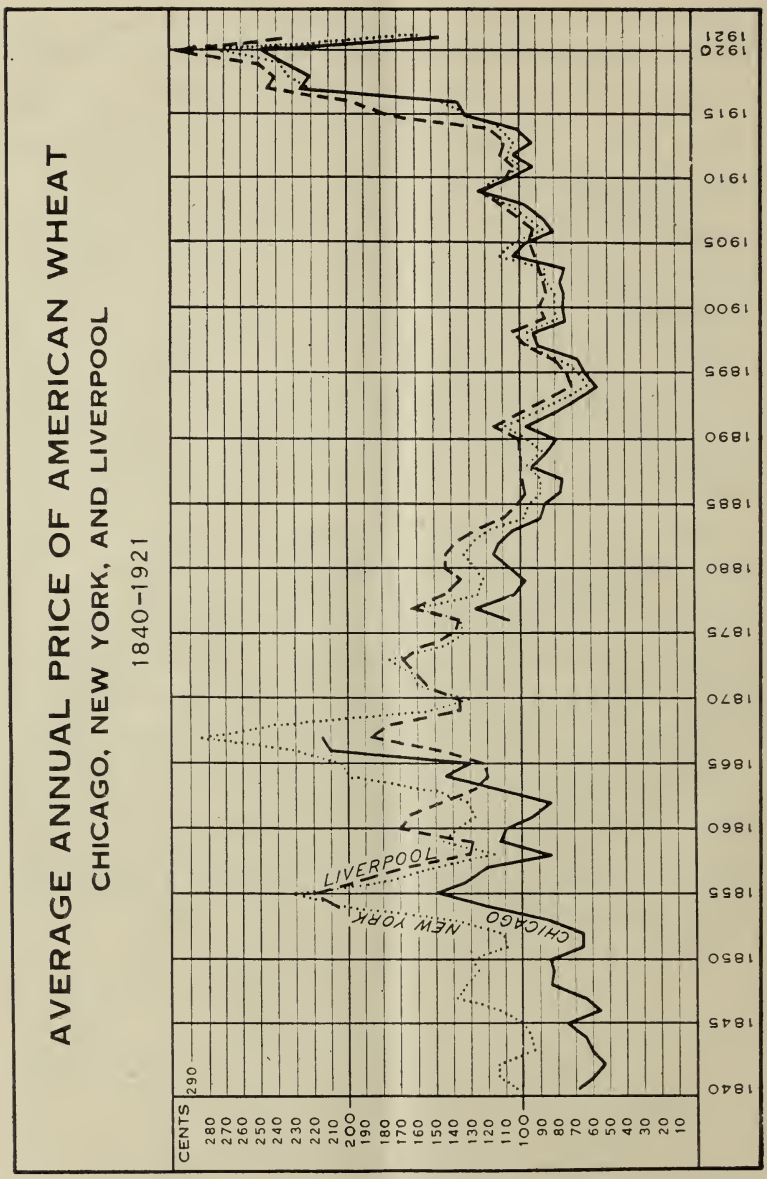

FIG. 61.—Trend of average annual price of American wheat in Chicago, New York, and Liverpool from 1840 to 1921. In general, the spread in price has decreased steadily throughout the years, but prices in the three markets are not readily comparable.

The Situation and Outlook.

What does the future hold for the American wheat grower? After the foregoing summary of the economic phases of the production and marketing of wheat, this is a natural and vitally important question. Any attempt to answer it requires consideration of the long-time trends (1) in the prices and purchasing power of wheat; (2) in acreage, acre yield, and production; (3) in consumption and export; and (4) in total population and the numbers living under rural and urban conditions in this country.

Farm Price and Purchasing Power of Wheat.

The quantity of goods that can be bought for a bushel of wheat is more significant than the number of dollars or cents for which it will sell. In Figure 62 is shown the trend of farm price and of purchasing power in terms of the 1913 dollar, from 1866 to 1921.

On December 1, 1866, the currency price of wheat was slightly higher than the peak price on December 1, 1919, but the purchasing power per bushel in 1866 was some 30 cents higher. The price fell after the Civil War just as it has fallen since the World War. In both cases the fall has been due largely to deflation, and in both cases the purchasing power also has fallen farther in proportion; that is, the price of wheat has fallen more rapidly and farther than the average prices of all commodities. In purchasing power the price of 94 cents on December 1, 1921, was lower than the low price of 49 cents per bushel on December 1, 1894.

As acre yields vary greatly from year to year, the farm value and purchasing power per acre (fig. 62) are a better index of the returns to farmers than are the price and purchasing power per bushel. A relatively high price per bushel was paid for the 1916 crop, but the farmer did not have as many bushels as usual. In fact, on the average, he received less in purchasing power for the 1916 crop than for the 1915 crop, which he sold at a lower price but of which he had many more bushels.

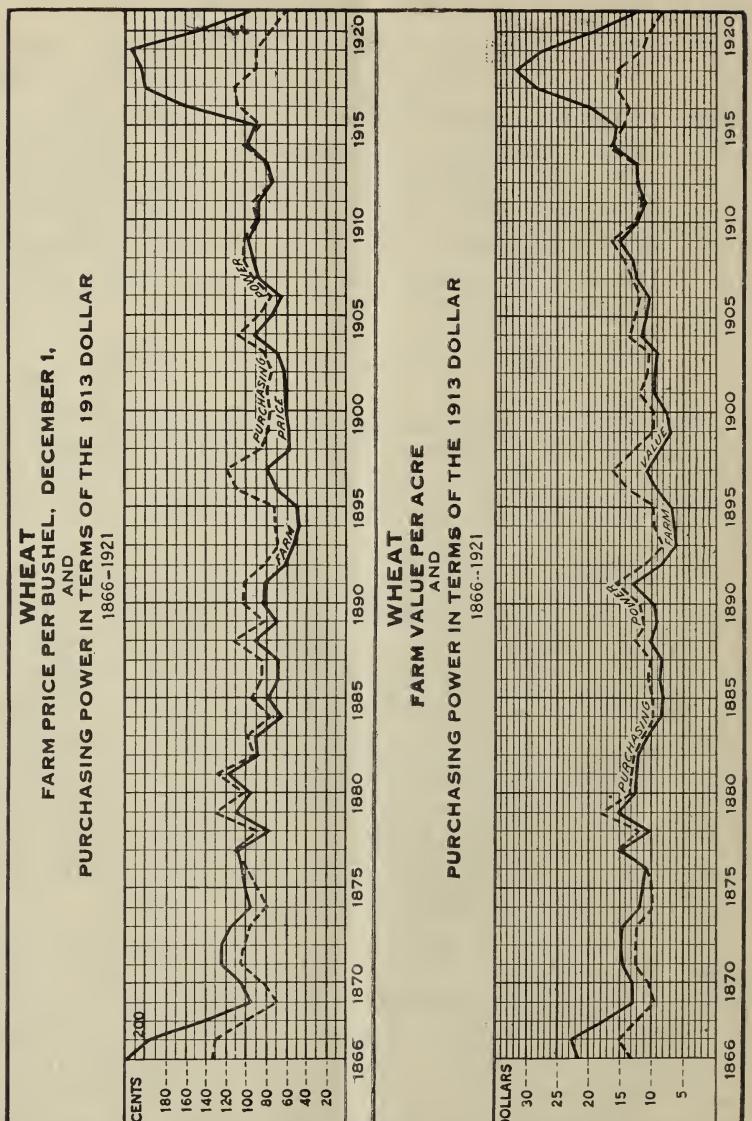

FIG. 62.—The purchasing power of wheat per bushel and per acre, in terms of the 1913 dollar, was low during and after the Civil War, fairly high from 1877 until 1909, and exceedingly low during the World War, in comparison with the farm price of wheat.

At the present time (May 1, 1922) the farm price of wheat is considerably higher than at the end of 1921, and, as the prices of other commodities farmers buy (Fig. 40) are decreasing slowly, the purchasing power of wheat is rising.

Trend of Acreage and Production.

The trends of acreage, acre yield, and production have been shown in Figure 7. Acreage has increased steadily as the country has developed. Average acre yields also increased about 25 per cent, or from 12 bushels to 15 bushels, in the 25 years from 1890 to 1914. As a result, production

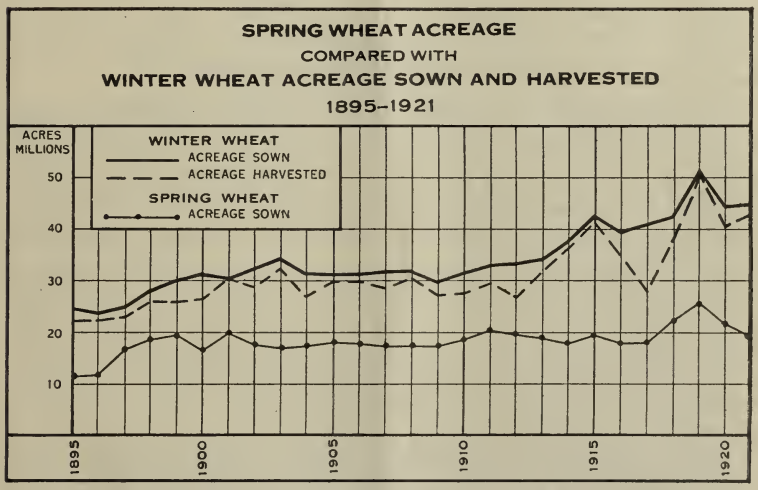

FIG. 63.—The acreage of winter wheat sown is larger than that of spring wheat and has tended to increase faster both before and during the World War.

increased steadily. The average acreage harvested in the 10 years before the war (1905–1914) was about 48 million acres, of which over 18 millions were spring wheat and nearly 30 millions were winter wheat (Fig. 63). As the average abandonment of winter wheat acreage sown was about 8.5 per cent in those years, nearly 33 millions of acres of winter wheat were sown annually.

During the World War acreage and production were greatly stimulated by patriotic impulses and by high prices. At the same time average acre yields decreased slightly, probably on account of unfavorable seasons and less ade-

quate farming methods due to the decreased labor supply. The enormous total of 75,684,000 acres was grown in 1919, but this dropped to somewhat more than 61 million and 62 million acres, respectively, in 1920 and 1921. Further decrease in acreage perhaps may be looked for, but every effort should be made to maintain high acre yields.

The increase in winter wheat acreage since 1911 has been proportionately greater than that of spring wheat. In 1919 the acreage of winter wheat harvested was 50,494,000 acres, in 1920 is was 40,016,000 acres, and in 1921 it was 42,702,000 acres, after decreases of about 2, 11, and 5 per cent, respectively, caused by winterkilling, had been subtracted. This means that about 45 million acres of winter wheat were sown for both 1920 and 1921, compared with an average of about 33 millions in the 10 years from 1905 to 1914.

The preliminary estimate of the acreage of winter wheat sown in the autumn of 1921 for the crop of 1922 is 44,293,000 acres, or scarcely any decrease from 1920 and 1921. However, unfavorable conditions in the autumn and winter, especially in the central part of the Great Plains area, have greatly injured the plants, and an average abandonment of 14.4 per cent has been estimated. This unusually high abandonment reduces to 38,131,000 acres the area of winter wheat estimated to be remaining for harvest in 1922, an area, however, which is still 5 million acres larger than the prewar average.

During the 20 years from 1898 to 1917, inclusive, the acreage devoted to spring wheat was fairly constant, with an average of 18,015,000 acres annually. The 20-million mark was reached only in 1911. The lowest acreage recorded in this period was 16,259,000 acres in 1900. In 1918 and 1919 the acreage was increased to 22,051,000 and 25,200,000 acres, respectively. In 1920 it dropped to 21,127,000 acres and in 1921 to 19,706,000 acres, which was still about 10 per cent above the prewar average.

Unfavorable spring conditions have much retarded the sowing of spring wheat in 1922. Probably this will result in a decreased acreage. If this proves to be true, and the facts will be known before this is printed, a decreased production of spring wheat is probable in 1922, which will be one factor in obtaining a better price.

With about 4½ million acres less of winter wheat remaining for harvest in 1922 than were harvested in 1921, and with a probable decrease in acreage of spring wheat in 1922, a decreased production of all wheat seems likely to result.

Domestic Use of Wheat.

Most of the wheat crop of the United States is consumed annually within the country (Fig. 64). A small percentage of the crop is used for seed; a varying quantity is exported; and the remainder, also variable in quantity, is held in the country as carry-over from year to year.

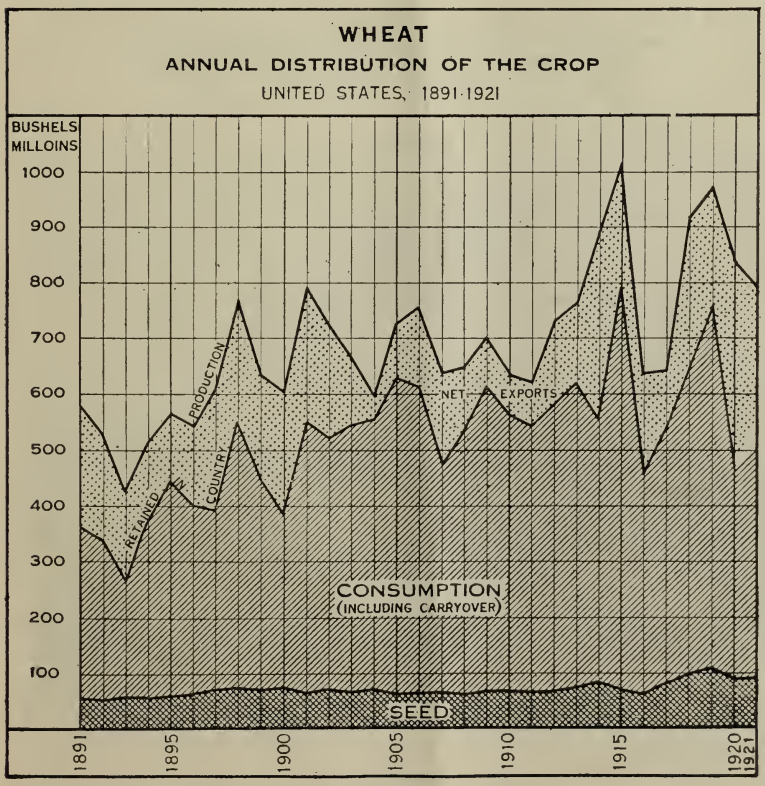

FIG. 64.—Disposal of the American wheat crop in the last 30 years. Compare with same factors on a per capita basis in Figure 71.

The total consumption can not be determined directly, but only by subtraction of all other items. It varies slightly, no doubt, from year to year in relation to the price of flour and the general condition of business and employment. Consumption increases with total population, of course, and per capita consumption is increasing also. During the war consumption was decreased by the use of wheat substitutes, but that was only a temporary condition.

Carry-over, also, can not be determined accurately by direct methods. In a long period of time it becomes increasingly negligible, as the carry-over of one year is eaten or exported in the next. At the end of 25 or 50 years, there-

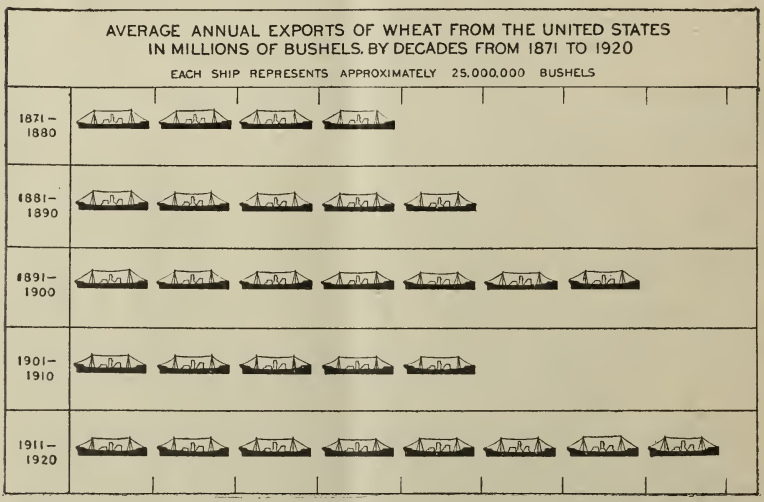

FIG. 65.—Wheat exports increased steadily in the 30 years from 1870 to 1900, decreased in the next 10 years, and increased enormously in the last 10 years, stimulated by war-time needs.

fore, only the final carry-over need be considered, and the consumption is found by subtracting the total seed requirements and exports. These trends, reduced to this average condition, are shown later on a per capita basis in Figures 71 and 72.

Exports.

The United States has exported a surplus of wheat in every year of its history, except 1836. International trade in wheat on a large scale may be said to have begun in 1850, in which year the repeal of the British Corn Laws went into

effect. At this time practically all of the wheat of the United States was produced east of the Mississippi River, and there usually was not a large quantity available for export. The trend of exports by decades since 1871 is shown in Figure 65 and by years since 1849 in Figure 67.

The Civil War cut off the southern market for northern wheat, and a good demand in Europe at the same time caused a large increase in the exports during those years. Following this war there were a few years of small exports, but by 1869 they had returned to the Civil War level. Exports increased rapidly from 1866 to 1880, after which there was a decline until 1890. This was followed by a period of large exports until 1902. From 1878 to about 1902 was the great surplus-producing period of the development of wheat production in the United States. From 1903 to 1913 the exports were much less than in the previous decade (Fig. 67).

FIG. 66.—Wheat being delivered through spouts from the bins of a waterfront elevator into the hold of a steamer, for export. Wheat for export is loaded into ships at ports on the Great Lakes, the Gulf of Mexico, the Atlantic Ocean, and the Pacific Ocean. At Pacific Coast ports, much of the wheat still is handled in bags instead of in bulk.

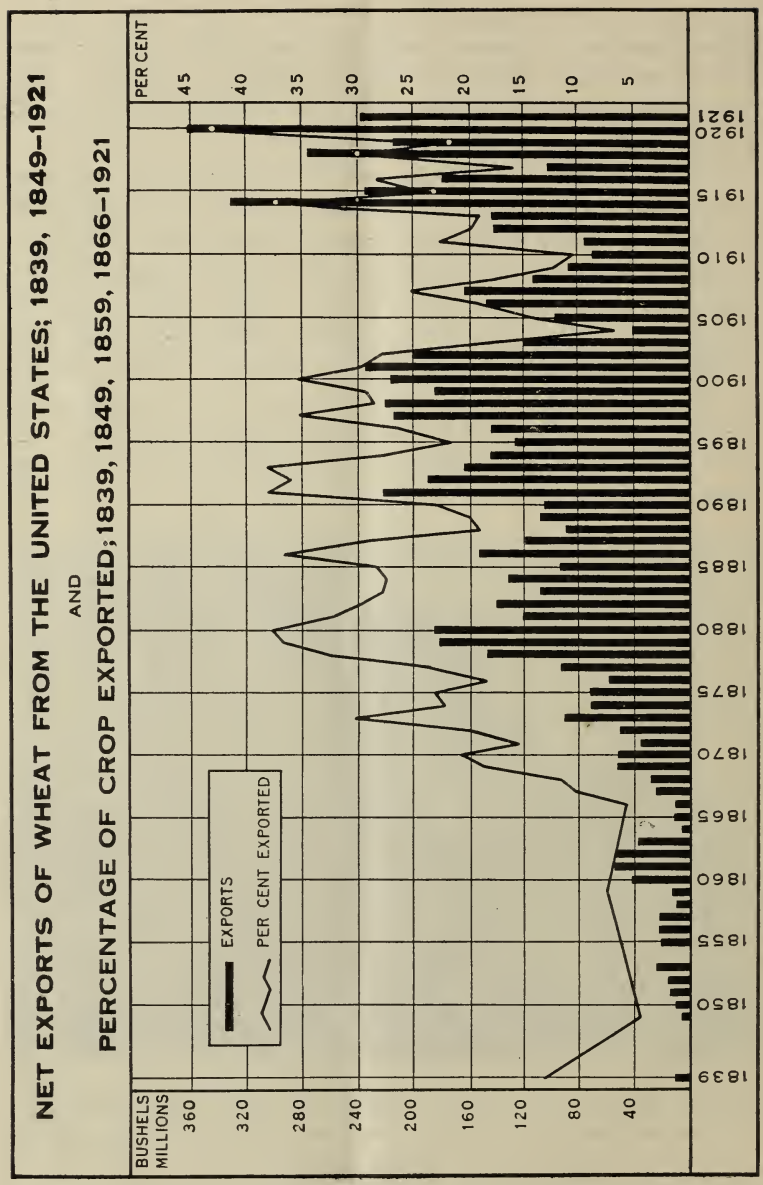

FIG. 67.—Exports vary much more than production, depending partly on foreign demand. In general, rapid extension of wheat production in the last quarter of the last century caused high exports, representing a high percentage of our total production. After a decade of decline the World War stimulated still greater exports but no larger percentage of the total.

The exports of the recent war period seem very large, but in percentage of the total of the crops produced they have not been greater than the exports of the period from 1880 to 1900. It is probable, however, that the future will show a continuation of the prewar trend of the years 1903 to 1913, inclusive.

International Trade in Wheat.

All the countries in the world are tied together through international trade in wheat (Figs. 68 and 69). The annual surplus from the great producing countries is poured into the consuming countries which do not produce enough to supply their own needs. Russia has been our greatest competitor in production and the United Kingdom our greatest buyer. The effect of the war upon the movements in wheat may be seen by comparing the movements in 1920 with the average movements in the five-year prewar period, 1910–1914, inclusive. The biggest and most significant change is the elimination of Russia as a producing country. Lack of the Russian surplus was made up by increases in production in the United States, Canada, and Argentina. The great reduction in India is due to a poor season in 1920, and the same was true in 1919 also. A most important economic question is how the future demand for our wheat will be affected by the return of Russia to her former place in international trade. Will Russia come back, and how rapidly? The question of how far Canada, Argentina, and India can continue to increase their acreage and production also is very important to us.

Population and Future Production.

Since Colonial times the United States has been an exporter of wheat. For nearly half a century our wheat exports have been large in quantity and very important in our total international trade in agricultural products (see Figs. 2, 65, and 67). During the last 20 years, however, the volume of these wheat exports has been decreasing, except under the artificial stimulation of the recent war period.

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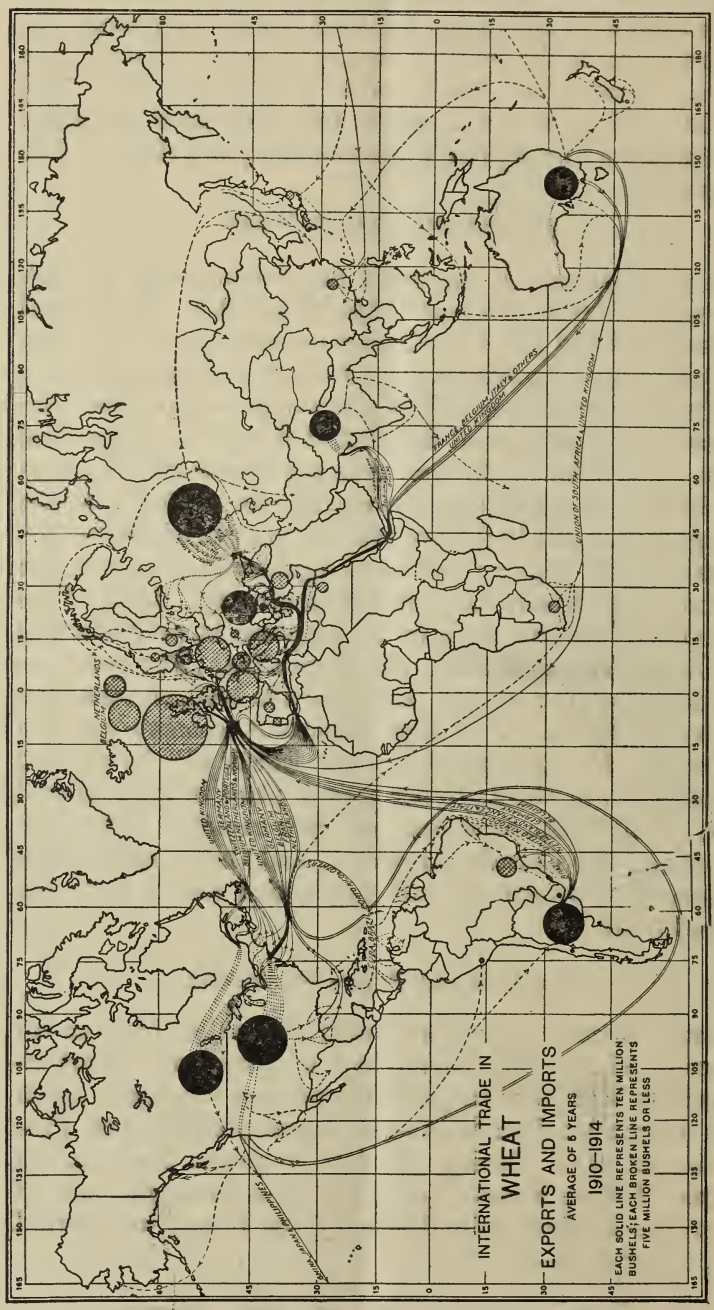

FIG. 68.—International trade in wheat before the World War, showing surplus production, trade routes, and destination. The two hemispheres are fairly well balanced in production. Western Europe is the great purchaser. Exports are represented by solid black circles; imports by shaded circles.

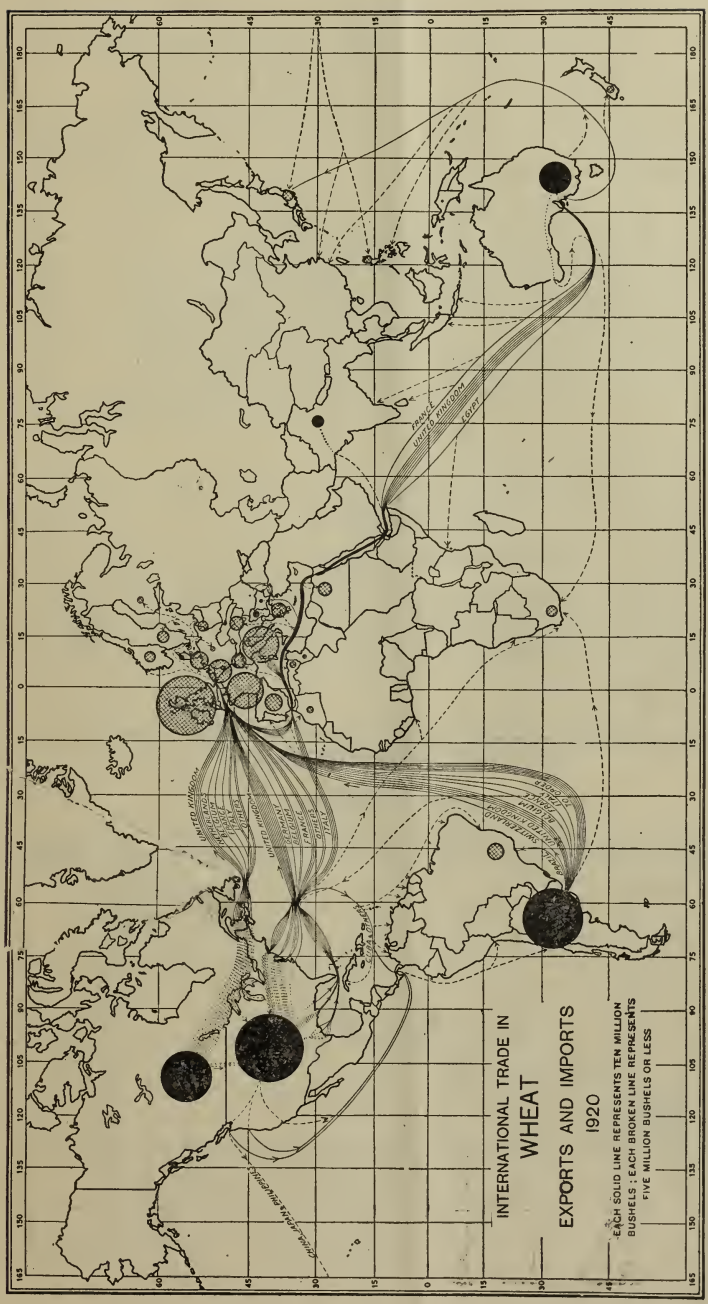

FIG. 69.—International trade in wheat after the World War, showing surplus production, trade routes, and destination. The western hemisphere has greatly increased its production, while production in the eastern hemisphere has enormously decreased. Russia and Hungary produce no surplus, while India has had two bad crop seasons.

This decrease has been due chiefly to our steadily increasing population (Fig. 70) and the lack of new lands suitable for profitable wheat production under present conditions.

Increase in population has been due partly to births and partly to immigration. The birth rate is affected somewhat by economic conditions in this country. Immigration is affected by legislation here and by economic conditions here and abroad. Without question our population will continue to increase, though the rate will be governed by the factors named. Increasing population will require a proportionately increasing supply of wheat. Wheat production, however, has been increasing less rapidly than population in this country, and it is very probable that this will continue to be true, at least until we reach the point where we consume practically all we produce.

Per capita consumption of wheat in this country has been increasing steadily during the last 80 years at least (Figs. 71 and 72). This has been due partly (1) to great improvement in milling processes, which make bread more attractive; (2) to increasing prosperity, which enables more people to eat white bread; and (3) to an increasing proportion of our population in cities.

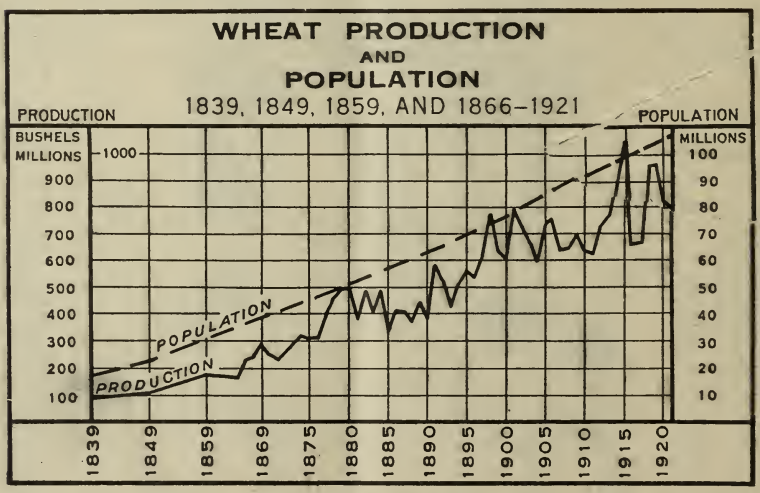

FIG. 70.—Population has increased more rapidly in the United States in the last 20 years than has wheat production, in spite of enormous production during the World War.

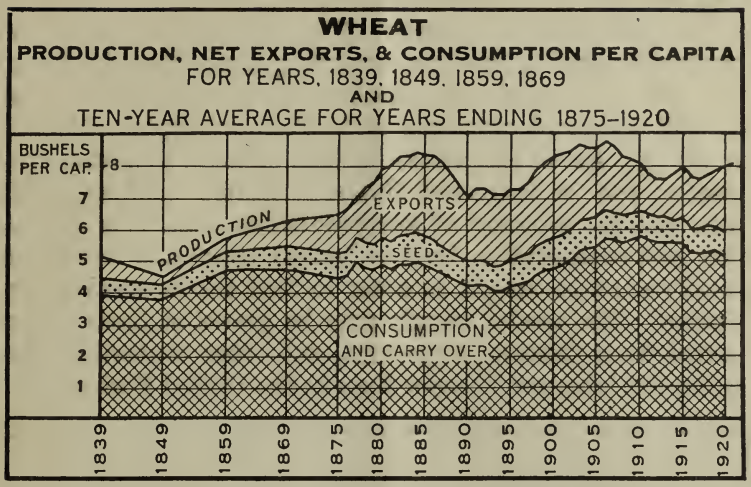

Fig. 71.—On a per capita basis consumption is increasing and production and exports are decreasing.

It is certain that city dwellers consume more wheat per capita than do those who live in villages and in the country. This probably is due in part to the lack of gardens in cities and in part to the comparative cheapness of bread and the further fact that no cooking is required. The proportion of the total population living in cities is increasing rapidly, which is a factor in the present and future trend of wheat consumption.

Per capita consumption increased (Fig. 72) from 3.8 bushels, the average of 1839 and 1849, to 4.9 bushels as the average from 1875 to 1884, and to 5.6 bushels as the average from 1905 to 1914. This rising trend, interrupted by the World War, doubtless now has been resumed. How much longer will it continue? In some countries of Europe, especially Belgium and France, per capita consumption has risen to about 8 bushels of wheat annually.

With increasing population, increasing per capita consumption, and decreasing per capita production (Fig. 72), there is a steadily increasing demand for our wheat at home. In comparatively a few years, if present trends continue, we shall be eating all that we produce. Of course production

can and will be increased if the prices paid for wheat will make such increase profitable. The greatly increased wheat production during the war, occurring under the stimulus of very high prices and of patriotism, was partly at the expense of well balanced rotations and other principles of sound farming. As wheat prices become better in future, production can be increased through the use of more fertilizer and the farming of less productive land. As production and consumption tend to become equal new sources of supply must be sought in order to feed the increasing population. The needed supply may be grown at home or imported from Canada, Argentina, and other countries where lands and labor are cheaper than in the United States.

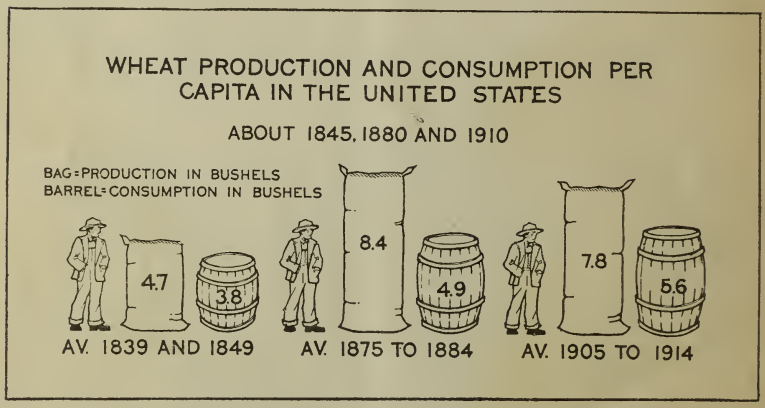

FIG. 72.—Per capita production has reached its maximum and is slowly declining, while per capita consumption slowly rises.

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